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June 20, 1989

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RESEARCH DEVELOPMENT COSTS
FOR
NEW BOLT ACTION RIFLE (NBAR)

RESEARCH DEVELOPMENT COST ESTIMATE: Jan.'89 thru Oct.'91

1. Initial Design	=	365 M
2. Build Initial Design Prototype Guns(3)	=	184 M
- Preliminary Prototype Tooling	=	80 M
3. Design Review Team Analysis	=	35 M
4. Test Phase I Prototypes	=	74 M
5. Redesign After Phase I Test	=	155 M
6. Build Phase II Design Samples (15)	=	159 M
- Prototype Tooling	=	160 M
- Plant Assistance	=	35 M
7. Test Phase II Samples	=	70 M
8. Redesign After Phase II Testing	=	141 M
9. Build Design Acceptance Guns (30)	=	242 M
- Prototype/Permanent Tooling	=	105 M
- Plant Assistance	=	45 M
10. Test Design Acceptance Guns	=	72 M
11. Minor Redesign & Transmittal To Production	=	13 M
12. Draft Manual	=	25 M
13. Test Ammunition Cost 55,000 Rounds (5,000 Rds 1990 x .25) (50,000 Rds 1991 x .25)	=	14 M

TOTAL DEVELOPMENT COST (1989 DOLLARS) = 1,974 M

RESEARCH MANPOWER ESTIMATE: May'89 thru Oct.'91

1. Research Engineer	=	4.94 man years
2. EDL Engineer	=	1.03 man years
3. CAD Designer	=	1.90 man years
4. CAD Detailer	=	1.74 man years
5. Draftsman	=	.25 man years
6. Model Shop Personnel	=	4.18 man years
7. N/C Programmer	=	2.08 man years
8. Test Lab Personnel	=	2.50 man years

TGB:cap
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The purpose of the New Bolt Action Rifle (N'BAR) is to offer a replacement for the M/700 'BDL' Rifle currently being produced. The new design parameters will include:

- o Detachable Magazine Box
- o Improved Fire Control
 - No Connector
 - Two Trigger Pull Springs (Low Rate Spring)
 - Sealed Fire Control
 - Balanced Trigger
 - Trigger & Sear Block
 - Non-Retrofittable to M/700
- o Bolt Lock w/Override
- o New Scope Mounts - Possibly aftermarket bases and rings. To be offered with rifle package.
- o New Extractor System
- o New 'Custom Shop' Barrel Contour
 - Mountain Rifle Crown
- o Improved Bedding/Accuracy Features
 - Example:
 - Thicker barrel bracket
 - Relieved thread - rec. fit & full hub bearing
- o M/700 Receiver to start with same round blank size and cosmetically altered behind front ring of steel over locking lugs.
- o New Wood Stock - Cosmetically altered for fittings/dress up/checkering

The "N'Bar" Design features will initially be produced in five calibers (30-06, 270, 280, 25-06 & 7MM Mag.) during the first year of introduction. These design/cost estimates are based strictly on introduction of these five calibers only in long action standard and mag. calibers only. If at a later point in time other calibers and short actions are added to this program, they will have additional development and introduction costs added.

- Initial Design

Jan.'89 - Dec.'89

This includes preliminary experimental development work, sketches, scenarios, layouts, design, computer modeling, detailing and checking. This design will be a redesign of the existing M/700 Rifle currently in our line, only in those areas so stated above in the design parameters section. Short actions and additional calibers will be considered during initial design to allow them to be compatible for design inclusion at a later time. Personnel required to accomplish this will include: one Research Engineer full time, one Cad Designer and one CAD Detailer, and one Research Engineer 50% of time, as well as some part time help from one EDL Engineer, Model Maker, N/C Programmer & Tester.

**- Send Vendor Parts Out For
Manufacturability and Quotation Estimate**

Jan.'89 - May'90

Early vendor consultation and input is required due to many parts for detachable magazine box, fire control, scope mounts and extractor being vendor supplied parts with long lead times and vendor development input requirements for the design. 'High spot' estimates will be pursued early to determine feasibility of producing at a competitive cost. We will also look at after market products already developed, such as quick klip for a detachable magazine box and numerous scope mount/ring manufactures. A decision will have to be made at this time for project direction to go with a total Remington design magazine box or after market adaptation.

- Build Initial Design Prototype Guns

Sept.'89 - Jan.'90

At least three prototype guns will be built: one in cal. 30-06 to cover similar calibers of 280, 270, 25-06, one in 7MM Rem. Mag. for Mag. Cal. and one for esthetic evaluation in standard head size caliber. All common parts with M/700 will be procured from the plant, current inventory. All newly designed parts will be fabricated by Remington where possible or be developed by outside vendors with Engineering/Development assistance from Remington. Personnel required will be: one Research Engineer, one CAD Designer, one CAD Detailer, one N/C Programmer part time and two Model Makers full time, one part time.

- Initiate Design Review Team Analysis

Dec.'89 - Feb.'90

Their purpose will be to review design at this point and look at design objectively. Input is necessary from Process Engineering, Chemical/Materials Engineering, Arms Service feedback, Legal, as well as other Designers. Each group will review design as to potential 'Roadblocks' and feasibility to produce an acceptable design.

- Test Phase I Prototypes

Jan.'90 - Feb.'90

The two test prototypes - one standard caliber and one magnum caliber will be preliminary tested as to fit, form and function. These test guns will show up any major or minor design shortcomings prior to building multiple test guns for evaluation of function, accuracy, endurance. Testing will consist of dry firing/cycle, live firing, function and accuracy. Extended testing of one or both guns may be desired at this time depending on preliminary functioning results.

- Test Phase I Prototypes - Cont'd.

A Marketing/Sales Manager Meeting will be held to evaluate styling, aesthetics, features utilizing the third prototype gun built. Their decisions will affect time for redesign and rebuild of models for both testing and aesthetics. Personnel required are: one Research Engineer full time, part time allowances for one EDL Engineer, one Model Maker, one CAD Designer and one Tester.

- Redesign (Decision Point)**Feb.'90 - May'90**

Redesign begins as soon as problems arise in Phase I assembly or testing, and continues through Phase I Testing. Depending on the extent and nature of parts requiring redesign as a result of testing, Marketing, Legal or Design Review Team recommendations, will greatly affect straight forward progress or delays for redesign, reevaluation and retesting. Depending on how much and how many components need attention will constitute a need for additional personnel such as: one Research Engineer, one EDL Engineer, one CAD Designer, one CAD Detailer, one Model Maker full or part time. Styling, stock design, weight, balance, safety will need to be addressed at this phase. Also, high spot economics of the whole program will need to be completed at this time, and evaluated to determine project feasibility and path forward or redesign.

- Build Phase II Design Samples**May'90 - Aug.'90**

A total of 15 design sample guns will be built (3 of each caliber) for this Phase II. The majority of the design, legal, and styling questions will be resolved during this phase. As many vendor sample prototype parts as are available, will be used. Other non-vendor parts will be made by Production, Model Shop or N/C Shop. Ongoing vendor visits will be required to consult and fabricate test sample parts from vendor temporary tooling. Some in-house finishing of these vendor components will be necessary by the Model Shop or N/C. Personnel required to implement this Phase II are: four Model Makers and two Engineers will be required full time, one N/C Programmer full time.

- Test Phase II Design Samples**Aug.'90 - Oct.'90**

These design sample guns will be tested for function, endurance, strength, blow/up, crud and temperature extreme tests, safety performance, dry firing and field function. Two 30-06 and two 7MM Rem. Mag. guns will be subjected to an intentional abuse test. This may constitute some design changes or modification as deemed necessary from test results. Personnel required are: one Engineer and two testers will be required full time and one Model Maker and N/C Designer part time.

- Redesign

Sept.'90 - Dec.'90

Redesign begins as soon as problems arise during Phase II Testing and continues throughout testing. The test results will determine redesign effort needed to correct any deficiencies of the design. All styling, Marketing, and Legal concerns will be finalized by this time. If a major redesign or management change in criteria is required a substantial amount of time and effort will be required to complete. Personnel required will be one EDL Engineer, one Research Engineer, one CAD Designer, one CAD Detailer will be required full time.

- Build Design Acceptance Guns

Nov.'90 - Apr.'91

The purpose of the design acceptance test is for finalizing design component parts to be fully tested in several guns prior to design transmittal to the plant. A total of 30 guns will be built including all five calibers for a large enough sample to be statistically sound. The majority of parts will be vendor produced parts on permanent tooling and in-house parts produced as much as possible on production machinery that will be used in the process of full production schedules. Some component parts may need finishing operations by the R & D Model Shop or N/C Shop. Also, N/C will aid FMS Operations for programming and debugging. Other current production parts required as used, or if in need of modifications will be procured from the plant. Personnel required will be: two Engineers, two N/C Programmers and two Model Makers full time. Some plant personnel will be required part time.

- Test Design Acceptance Guns

May'91 - July'91

Design acceptance testing of 30 gun samples is the final test performed on the design prior to transmittal. No alterations or modifications are allowed during this testing phase to the test guns. The Test Lab has complete control of the testing and performs all testing it deems necessary to verify design for release to production. Control Gun Testing will be run concurrently with New Design Acceptance Test Guns to compare current design with new offering, also to include competitive products where appropriate. Testing will include endurance, field function, drop, dry fire, strength, intentional abuse, temperature extreme, solvent testing and accuracy. When the Test Lab has passed these guns on all tests, a written report certifying the gun is acceptable for transmittal is filed. Personnel required are: one Engineer and four Test Lab personnel full time.

- Mini Redesign and Drawing Transmittal July'91

By this phase of development, the design is firm and no major setbacks should occur. Only minor changes or updates should take place. Changes will be limited to process updates, improving endurance, cost effectiveness, and improved functionality only on parts found to be problem areas from previous testing. Initial transmittal of Research Model drawings and specifications takes place at this time. Personnel required are: one Engineer and one CAD Draftsman full time.

- Project Approval (Decision Point) July'91 - Aug.'91

During this period, final management approval of the design is given and money is released to begin production tooling. All pertinent economics and production process estimates will be completed for this project approval report.

- Draft Manuals Aug.'91 - Oct.'91

This involves development of text and illustrations for the owners manuals and instruction booklets and field service manuals. This will be prepared in conjunction with a commercial printer. Personnel required are: one Engineer and one Draftsman part time with input required from Legal Department and Customer Service.

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