

ARMED SERVICES BOARD OF CONTRACT APPEALS

Appeal of --)
)
Intercontinental Manufacturing Co.) ASBCA No. 48506
)
Under Contract No. DAAA09-90-C-1071)

APPEARANCES FOR THE APPELLANT: Jeffrey N. Eisenstein, Esq.
Richard B. Clifford, Jr., Esq.
Andrew D. Irwin, Esq.
Howrey & Simon
Washington, DC

APPEARANCES FOR THE GOVERNMENT: COL Michael R. Neds, JA
Chief Trial Attorney
MAJ Bryant S. Banes, JA
CPT Christopher Hellmich, JA
Trial Attorneys

OPINION BY ADMINISTRATIVE JUDGE ELMORE

Intercontinental Manufacturing Co. (IMCO or appellant), a subdivision of Datron, Inc. (Datron), has appealed the contracting officer's (CO) 16 February 1995 denial of its equitable adjustment (EA) claim in the amount of \$11,942,257.00.¹ IMCO seeks recovery for heat treatment process changes, phosphate coating process changes, and defective BDU-45 charge case interference (app. br. at 2).² Only entitlement will be decided (tr.1/46).

FINDINGS OF FACT

SOLICITATION

1. The U.S. Army Armament and Chemical Command (AMCCOM, Government, or respondent) on 16 July 1990 issued Solicitation No. DAAA09-90-R-0498, subsequently Contract Number C-1071 (contract C-1071), soliciting proposals for the production of 12,695 MK-82; 30,420 BDU-50; and 19,783 BDU-45 bomb bodies. The MK-80 series bomb was a general purpose bomb and included the MK-82, a 500 pound bomb and the subject of this appeal; the MK-83, a 1,000 pound bomb; and the MK-84, a 2,000 pound bomb. The BDU-45 was the Navy's, and the BDU-50 was the Air Force's, practice bomb version of the MK-82 bomb. The technical activity for the contract was the Navy Pacific Missile Test Center (PMTTC), now the Naval Air Warfare Center (NAWC), Point Mugu,

California and the requiring activities for the contract were the Navy and Air Force. (R4, tab 1; AR4, tab G-5 at 13, 147, 153; tr. 6/122-23) The solicitation provided prospective bidders with the following pertinent information (R4, tab 1; SR4, tab 84; finding 18 *infra*):

SECTION A - Supplemental Information

....

A-2 NOTICE OF PHOSPHATE COATING REQUIREMENT
AMCCOM (MAR 1998)

This solicitation and any resulting contract are subject to Federal Specification TT-C-490C Type I, Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings.

....

A-5 THE FOLLOWING CHANGES TO ADL 1380545 ARE
INCORPORATED:

....

DRAWING 1380547, REV AH IS CHANGED IN
ACCORDANCE WITH DRAWING AT ATTACHMENT 09 AS
LISTED IN SECTION J.

DRAWING - ADL SHEET NUMBER 0020 IS CHANGED IN
ACCORDANCE WITH DRAWING AT ATTACHMENT 18, AS
LISTED IN SECTION J.

DRAWING 923AS182 IS CHANGED IN ACCORDANCE
WITH DRAWING AT ATTACHMENT 28 AS LISTED IN
SECTION J.

....

SECTION C - Supplemental Information

C-1 DRAWINGS/SPECIFICATION
AMCCOM (MAR 1988)

In addition to the drawing(s) and/or specifications listed below, other documents which are part of this procurement and

which apply to Preservation/Packaging/Packing and Inspection and Acceptance are contained elsewhere.

The following drawing(s) and specifications are applicable to this procurement.

MK82:

TDPL ADL 1380545 WITH REVISIONS IN EFFECT AS OF 16 AUG 88 (EXCEPT AS FOLLOWS):

AUTOMATED DATA LIST ADL 1380545, REV A, DATED 16 AUG 88 AND ALL DOCUMENTS THEREON, SHALL APPLY TO THIS PROCUREMENT.

BDU-45:

TDPL ADL 923AS116 WITH REVISIONS IN EFFECT AS OF 28 MAR 88 (EXCEPT AS FOLLOWS):

AUTOMATED DATA LIST ADL 923AS116, REV A, DATED 28 MAR 88, AND ALL DOCUMENTS REFERENCED THEREON, SHALL APPLY TO THIS PROCUREMENT.

BDU-50:

TDPL ADL 923AS651 WITH REVISIONS IN EFFECT AS OF 7 NOV 87 (EXCEPT AS FOLLOWS):

SEE SECTION A NARRATIVE FOR CHANGES TO ABOVE LISTED ADLS.

2. The solicitation provided prospective bidders with the following (R4, tab 1; Gov't app. A, tab 54):

SECTION E - Supplemental Information

....

E-2 HIGHER-LEVEL CONTRACT QUALITY
REQUIREMENT (GOVERNMENT SPECIFICATION)
52.246-11 (APR 1984)

....

(b) The Contractor shall comply with the specification titled MIL-Q-9858 [QUALITY PROGRAM REQUIREMENTS], in effect on the contract date, which is hereby incorporated into this contract.

....

E-4 INSTRUCTIONS REGARDING SUBMISSION OF
FIRST ARTICLE (CONTRACTOR TEST)
AMCCOM (OCT 1988)

(a) First Article Inspection. The First Article shall consist of the items listed in the following paragraph (b), and shall be representative of items to be manufactured using the same processes and procedures as contract production. The First Article shall be inspected and tested to all requirements of only the drawing(s), and all requirements of the specification(s) referenced thereon, listed in the following paragraph (b) except for:

(1) Inspections and tests contained in material specifications provided that the required inspection and tests have been performed previously and certified results of the inspections and tests are submitted with the First Article Test Report.

(2) Inspections and tests for Military Standards (MS) components and parts provided that (i) inspection and tests have been performed previously and results of the inspections and tests are submitted with the First Article Test Report, or (ii) certification of conformance for the components and parts are submitted with the First Article Test Report.

(3) Corrosion resistance tests over ten days in length provided that a test specimen or sample representing the same process has successfully passed the same test within thirty days prior to processing the first article, and results of the tests are submitted with the First Article Test Report.

(4) Life cycle tests over ten days in length provided that the same or similar item manufactured using the same processes has successfully passed the same test within one year prior to processing the first article, and results of the tests are submitted with the First Article Test Report.

(5) One-time qualification tests, which are defined as one-time on the drawing(s), provided that the same or similar item manufactured using the same processes has successfully passed the tests, and results of the tests are submitted with the First Article Test Report.

(b) The first article shall consist of the following items:

<u>QUANTITY</u>	<u>ITEM NOMENCLATURE</u>	<u>DRAWING</u>
6 COMPLETED UNITS & 4 SETS OF PARTS	BDU-50 A/B BOMBS	3003-923AS6 51
6 COMPLETED UNITS & 4 COMPLETED SETS OF PARTS INCLUDING PACKING AND PACKAGING MATERIAL	BOMB BODY ASSY. EMPTY, BDU-45/B	923AS116
6 COMPLETED UNITS	MK82	1380901
6 COMPLETE SETS OF PARTS INCLUDING PACKING AND PACKAGING MATERIAL		[PART NUMBER FOR MK-82]

(c) First Article Test Report. The First Article Test Report shall include five (5) copies of DD Form 1222, Request for and Results of Tests, prepared by the contractor and appropriately completed by the Government representative, and submitted through the Administrative Contracting Officer to the Contracting Officer. At the same time, an information copy is to be furnished Commander, US Army Armament, Munitions and Chemical Command, . . . Block 4 of Section B, DD Form 1222, shall specify, or (one copy) be provided as an attachment thereto, (i) all applicable drawing and specification requirements, and (ii) actual inspection and test results to include all measurements, recorded test data, and certifications if applicable, keyed to each drawing and specification requirement. . . .

(d) The approved First Article will not serve as a manufacturing standard.

(e) Notwithstanding the provisions of the product specifications or a waiver of first article, an additional first article sample or portion thereof, may be ordered by the Contracting Officer in writing when (i) a major change is made to the technical data, (ii) whenever there is a lapse in production for a period in excess of ninety days, or (iii) whenever a change occurs in the manufacturing process, material used, drawing, specification or source of supply. When conditions (i), (ii), or (iii) above occurs, the Contractor shall notify HQ, US Army Armament, Munitions and Chemical Command, . . . so that instructions for the submission, inspection and notification of results can be made. Costs of first article testing resulting from technical data changes will be borne by the Government. Costs of first article testing resulting from production process change or material substitution shall be borne by the contractor.

E-5 MILITARY SPECIFICATION MIL-Q-9858A AMCCOM (MAR 1988)

FAR 52.246-11 requires MIL-Q-9858A as a contractual requirement. Should your company be in contention for possible contract award, a preaward survey may be required. If an acceptable procedure is not in place at time of preaward survey, the offeror will be required to demonstrate that it can achieve the required written quality assurance procedures prescribed by the attached Contract Data Requirements List (DD Form 1423) prior to submission of first article samples to the Government (if applicable), or prior to initiation of production.

E-6 STATISTICAL PROCESS CONTROL (SPC) AMCCOM (OCT 1988)

a. SPC Plan: A plan for implementation of SPC shall be submitted by the contractor for review and acceptance by the Government within 90 days of this contract or modification. Regardless of the 90 day requirement, availability of the accepted SPC plan will be required prior to First Article submission (if

required) and prior to initiation of production. . . . Notification by the Government of acceptance or nonacceptance of the contractor's SPC plan shall be furnished to the contractor through the Procuring Contracting Officer (PCO).

The SPC plan shall be viewed as a section of the Quality Program Plan . . . , or the Inspection System Plan . . . , and will provide a time phased schedule of all efforts planned relative to total implementation of an SPC program. The plan will identify the:

- contractor's policy/procedures for applying SPC (where to begin and how to proceed with application),
- plans on when and how SPC will be required of vendors,
- SPC management structure within the corporation,
- SPC responsibilities of all involved personnel,
- training program and qualification of personnel in SPC techniques,
- process capability studies to be applied,
- general control chart policy including types of charts and rational for use, policy on establishment of rational subgroups, criteria for selection of sample size/frequency, procedures for establishment and updating of control limits, and criteria used for determining an out of control condition,
- corrective action procedures to be used, and,
- audit procedures to be used for validating the accuracy, adequacy and interpretation of control charts.

b. SPC IMPLEMENTATION: As part of the requirements of MIL-Q-9858, or in addition to the requirements of MIL-I-45208, the contractor shall control and/or validate the product quality whether produced at the prime contractor or vendor facility, using SPC techniques as

defined in American National Standards Institute (ANSI) Z1.1, Z1.2 and Z1.3/American Society for Quality Control (ASQC) B.1, B.2 and B.3. Application of SPC techniques shall be considered for all characteristics/processes (*i.e.*, processes that affect these characteristics), especially those characteristics identified as critical, special or major.

The contractor shall append the SPC plan as each operation is reviewed for implementation of SPC. Appendices will identify the process capability study and results, the control limit computation procedures, the sample size/frequency used for on-going control, the criteria to be used for modifying the sample size/frequency, and the criteria to be used for updating the control limits. A brief justification will be included for critical, special or major characteristics/processes which are deemed not suitable for application of SPC techniques. Documentation will be available for Government review.

Statistical evidence of product quality in the form of control charts will be prepared and maintained for each operation identified. All charts will be retained by the contractor for a minimum of 3 years and will be available for Government review.

When SPC has been fully implemented, the processes have demonstrated a state of statistical control, and the product conforms to final acceptance requirements, the contractor may request acceptance sampling be reduced/eliminated. At the discretion of the PCO, based on concurrence by the Product Assurance Directorate, the authorization for reduced/eliminated inspection may be granted or withdrawn.

E-7 INSPECTION CRITERIA AMCCOM (OCT 1998)

The Contractor shall perform, as a minimum, examinations and tests in accordance with specifications and/or Supplementary (or other) Quality Assurance Provisions (SQAPS or QAPS) and/or Quality Assurance Requirements (QARS) listed or referenced in Section C. . . . These minimum examinations and tests shall not be construed as relieving the Contractor of his responsibilities under terms of the contract

to furnish the Government with items fully in conformance with the requirements of the product drawings and specifications.

E-9 DESTRUCTIVE TESTING
AMCCOM (OCT 1988):

a. Where destructive testing of items or components thereof is required by contract or specification, the number of items or components required to be destructively tested, whether destructively tested or not, shall be in addition to the quantity to be delivered to the Government as set forth in the Schedule of items above, and all costs for destructive testing by the Contractor and items destroyed by the Government are considered as being included in the contract unit price. All pieces of the complete First Article shall be considered as destructively tested items unless specifically exempted by other provisions of this contract. . . .

....

SECTION L - Instruction and Conditions and Notices to Offerors

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L-18 ADDITIONAL ORDER OF PRECEDENCE
AMCCOM (MAR 1988)

Notwithstanding the Order of Precedence clause . . . 52.215-33^[3] contained in this solicitation the following shall apply in the event of an inconsistency within the Specification:

- (1) Technical Description Sheet (TDS) or exception to technical documents cited in Section C;
- (2) Drawings;
- (3) Detail specifications (including gage designs) for item(s) being procured;
- (4) Detail specification for material or operations;
- (5) General specifications for class of items; and
- (6) General specification for class of materials.

3. The assembly sequence for the MK-82, BDU-45 and BDU-50 bomb bodies was in accordance with the following drawings (tr. 8/52-61; SR4, app. A, tabs 4, 5, 7, 13, 106; ex. G-16):

MK-82	1380548M	CASING, BOMB BODY
	1380547AH	BODY ASSEMBLY, BOMB
	1380545 AD	BOMB ASSY, BOMB GENERAL PURPOSE, 500 POUND, MK 82 MOD 1, EMPTY
BDU-45	1380548M	CASING, BOMB BODY
	923AS118G	BODY, BOMB
	923AS116	BOMB, BODY ASSY, EMPTY, BDU-45/B
BDU-50	923AS183B	CASING, BOMB BODY
	923AS182D	BOMB BODY
	923AS651	BOMB, BODY ASSY, EMPTY, BDU-50A/B

4. The mechanical properties for the MK-82, BDU-45 and BDU-50 bomb bodies, called out in the notes on drawings 1380548M and 923AS183B, stated (AR4, tabs K-5, K-8a; ex. G-16):

1. MATERIAL: STEEL WHICH WILL PRODUCE THE FOLLOWING MINIMUM PHYSICAL PROPERTIES AFTER HEAT TREATMENT. HEAT TREAT AFTER WELDING.

YIELD STRENGTH - 70,000 POUNDS PER SQUARE INCH

TENSILE STRENGTH - 105,000 POUNDS PER SQUARE INCH

ELONGATION IN 2 INCHES - 16 PERCENT

3. NOSE WALL THICKNESS MAY VARY 45 PERCENT OVER THE MINIMUM REQUIREMENT FROM X ORDINATE .000 TO 8.357. WALL THICKNESS MAY VARY 28 PERCENT OVER THE MINIMUM REQUIREMENT FROM X ORDINATE 8.357 THRU 26,786 AND 25 PERCENT FROM X ORDINATE 26,786 TO THE END OF THE CASING. AT NO POINT IS THE

THICKNESS TO BE LESS THAN THE MINIMUM DIMENSION SPECIFIED.

4. IF WELDED PIPE IS USED, THE LONGITUDINAL SEAM SHALL BE 180 DEGREES PLUS OR MINUS 90 DEGREES FROM THE CENTER-LINE OF THE INSERT HOLES.

5. Notes on sheet 1 of drawings 1380547AH, 923AS118G and 923AS182D stated, in pertinent part, as follows (AR4, tab K-3; ex. G-16):

2. After welding and subsequent heat treatment, in accordance with MIL-H-6875, the following requirements must be met:

...

....

7. GENERAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH DRAWING 2518492 WHICH TAKES PRECEDENCE OVER ANY REQUIREMENTS REFERENCED OR SPECIFIED HEREON.

....

8. AFTER MACHINING THE FACE AND INTERNAL DIAMETER OF THE NOSE, VISUALLY INSPECT EACH BOMB BODY NOSE AREA INCLUDING THE FACE, THE EXTERNAL AND INTERNAL AREAS FROM THE FACE TO 2.312 BACK FROM THE FACE FOR VISUAL DISCONTINUITIES SUCH AS LAPS, CRACKS, SEAMS, TEARS, ETC. . . . ANY DISCONTINUITY IS CAUSE FOR REJECTION OF THE BOMB BODY.

6. Sheet 1 of Drawing 1380545AD included, in pertinent part, the following notes (AR4, tab K-7):

6. ALL SURFACES THAT REQUIRE PAINTING SHALL BE CLEANED AND PREPARED THOROUGHLY IN ACCORDANCE WITH TT-C-490, TYPE I.

....

14. PAINT ALL EXTERIOR SURFACES OF ITEM 1, PRIOR TO ASSEMBLY OF ITEM 8 WITH EPOXY RICH PRIMER COATING, ITEM 20, .0006 TO .0009 INCH THICK. . . .

7. Note 1, Drawing 1252606H, RING, ADAPTER, BOMB BODY, stated (AR4, tab K-6):

1. MATERIAL: STEEL HAVING THE FOLLOWING MINIMUM PHYSICAL PROPERTIES AFTER HEAT TREATMENT.
YIELD STRENGTH - 70,000 POUNDS PER SQUARE INCH
TENSILE STRENGTH - 105,000 POUNDS PER SQUARE INCH
ELONGATION IN 2 INCHES - 16 PERCENT

8. Drawing 2518492M, MK-80 SERIES G. P. BOMBS, GENERAL REQUIREMENTS⁴ contained in pertinent part the following notes (R4, tab 2.5; ex. G-1; AR4, tab K-11):

(M101) 1. MATERIAL: UNLESS OTHERWISE SPECIFIED, ALL STEEL PARTS SHALL BE MADE FROM ELECTRIC FURNACE, OPEN HEARTH, OR BASIC OXYGEN FURNACE PRODUCED STEEL WITH PHOSPHOROUS OR SULFUR CONTENT NOT EXCEEDING .05 PERCENT (LADLE ANALYSIS). PARTS TO BE WELDED SHALL BE OF A QUALITY SUITABLE FOR WELDING, BOMB BODIES SHALL BE MADE FROM TUBING OR A BILLET. THE TUBING SHALL BE EITHER SEAMLESS OR WITH ONE LONGITUDINAL BUTT RESISTANCE WELD OR SUBMERGED ARC WELD. . . .

....

(M103) 5. HEAT TREATMENT:

A. ALL BOMB BODIES SHALL BE HEAT TREATED IN ORDER TO MEET THE PRESCRIBED MECHANICAL PROPERTIES.

- B. ALL WELDING AND FORMING SHALL BE COMPLETED ON THE BOMB BODY PRIOR TO HEAT TREATMENT. UNDER NO CONDITIONS WILL THE WELDING OF ATTACHMENTS OR ADDITIONAL HEAT FORMING, EXCEPT AS NOTED UNDER NOTE 5D. BE PERMITTED AFTER HEAT TREATMENT.
 - C. THE WHOLE BOMB BODY MAY BE HEAT TREATED BY NORMALIZING, NORMALIZING AND TEMPERING, OR LIQUID QUENCHING AND TEMPERING IN ORDER TO MEET THE PRESCRIBED MECHANICAL REQUIREMENTS.
 - D. HEATING FOR STRAIGHTENING SUBSEQUENT TO HEAT TREATMENT MAY BE PERMITTED, PROVIDED THAT THE HEATING DOES NOT INVOLVE TEMPERATURES WHICH RESULT, EITHER LOCALLY OR GENERALLY, IN LOWERING THE PRESCRIBED MECHANICAL PROPERTIES OF THE MATERIAL OR UNDUE DISTORTION OF THE STRUCTURES. A TEMPERATURE IN EXCESS OF 100°F, UNDER THE FINAL TEMPERING TEMPERATURE REQUIRED UNDER NOTE 5C WILL NOT BE PERMITTED.
- (M104) 6. PHYSICAL PROPERTIES OF WELDS: THE FOLLOWING REQUIREMENTS SHALL BE MET AFTER HEAT TREATMENT IDENTICAL WITH THAT USED FOR THE BOMB.
- A. TENSION PROPERTIES: THE MINIMUM YIELD STRENGTH OF WELDED JOINTS SHALL NOT BE LESS THAN THE MINIMUM SPECIFIED FOR THE MATERIAL OF WHICH THE BOMB IS CONSTRUCTED.
 - B. FLATTENING TESTS: THIS PROVISION APPLIES ONLY TO BOMB BODIES MADE

FROM WELDED TUBING. RINGS NOT LESS THAN TWO INCHES WIDE CUT FROM A BOMB BODY SHALL BE FLATTENED BETWEEN TWO PLATES PARALLEL TO THE AXIS OF THE RING, WITH THE WELD AT THE POINT OF MAXIMUM BENDING. NO FAILURE SHALL OCCUR UNTIL THE DISTANCE BETWEEN PLATES IS LESS THAN 87 PCT OF THE ORIGINAL INSIDE DIAMETER OF THE RING.

9. Federal Specification TT-C-490C, dated 18 March 1985, Amendments 1 and 2, dated 30 June 1987 and 29 June 1990 respectively, stated in pertinent part (R4, tabs 2-2, 2-4)⁵ :

1.1 Scope. This specification covers cleaning, surface conditioning and preconditioning methods for improving the corrosion resistance of ferrous metals. The application of chemical conversion and pretreatment coatings provides uniformly textured substrates for receiving and retaining paint, lacquer, etc. In addition, this specification covers suitable cleaning processes for nonferrous surfaces (see 6.1, 6.1.2).

....

1.2 Classification. This specification covers the following cleaning methods and surface pretreatment processes:

1.2.1 Surface cleaning shall be by any of the following methods as specified (see 6.4).

....

Method II - Solvent (immersion, spray or vapor).

....

1.2.2 Chemical conversion and pretreatment coatings shall be of the following types as specified (see 6.4).

Type I - Zinc phosphate

....

[Amendment 1]

1.2.2

ADD: under “type I - Zinc phosphate coatings”, the following coating weight classifications:

Class 1 - Spray application (150mg/sq ft min - 400 mg/sq ft max)

Class 2A - Immersion or Dip application (300 ± 50 mg/sq ft)

Class 2B - Immersion or Dip application (600 mg/sq ft min - 1000 mg/sq ft max)

[end of Amendment 1]

[Amendment 2]

1.2.2

Chemical conversion and pretreatment coatings shall be of the following types as specified below (see 6.4).

Type I - Zinc phosphate spray application (150 mg/sq ft min - 500 mg/sq ft max)

Zinc phosphate immersion or dip application
(300 mg/sq ft min - 500 mg/sq ft max)

[end of Amendment 2]

....

3.2 *Preproduction approval (type I only)*. Unless otherwise specified by the procuring agency, details of the proposed procedure, including chemicals and the equipment to be used by the contractor, shall be submitted in writing through the contracting office to the bureau or agency concerned and written approval received prior to the commencement of production (see 6.5). The exact designation of any material proposed for use, together with the name of the manufacturer, shall be stated. The proposed procedure shall include a detailed method of control including limits for time, temperature, concentration, and all other pertinent details. Six (4 in x 6 in) panels phosphatized by the proposed procedure shall be

submitted. Actual test results, indicating conformance to the specified test requirements should be submitted by the contractor along with phosphatized panels. No deviation from the approved process shall be permitted without prior written approval of the procuring agency concerned through the contracting officer. Approval of the process, materials, and equipment implies no guarantee of acceptance of the results obtained in use (see 6.5.1.1).

[Amendment 2]

3.2

Preproduction approval (type I only). Unless otherwise specified by the procuring agency, details of the proposed procedure[,] including chemicals and the equipment to be used by the contractor, shall be submitted in writing to the contracting office of the procuring agency concerned so that written approval can be granted prior to the commencement of production (see 6.5). The exact designation of any material proposed for use, together with the name of the manufacturer, shall be stated. The proposed procedure shall include a detailed method of control including limits for time, temperature, concentration and all other pertinent details. The contractor shall coat six (4 in x 6 in) panels by the proposed zinc phosphate coating procedure outlined for use in the contract. He shall test the coating weights of three of these panels and shall furnish the contracting officer a laboratory test report which confirms that the test panel coating weights are in conformance with the requirements of the contract. No deviation from the approved process shall be permitted without written approval of the procuring agency concerned through the contracting officer. Approval of the process materials and equipment implies no guarantee of acceptance of the results obtained in use (see 6.5.1.1). Any unapproved change to a government approved procedure will invalidate the procedure.
[end of Amendment 2]

....

3.4.3 Chemical conversion coating.

3.4.3.1 *Type I.* The properly cleaned articles shall be subjected to a balanced aqueous solution containing phosphoric acid, zinc, and accelerating agents until a uniform, insoluble, phosphate coating is

produced. Dated records should be maintained for the chemical analyses and additions made to the solutions.

....

3.5 General requirements.

3.5.1 Appearance.

3.5.1.1 *Type I, zinc phosphate.* Type I coating deposits shall be continuous, uniform in texture, evenly deposited and gray to black in color. The coating shall not be mottled in appearance nor show any smut, powder, corrosion products, or white stains due to dried phosphating solutions. There shall be a minimum number of contact marks from holders or racks.

Non-uniformity of color due to heat treatment, composition of the basis metal, the degree of cold work performed on the basis metal or presence of brown or orange stains inherent from the acidified final rinsing process shall not be cause for rejection.

3.5.2 *Phosphate coating weight (Types I . . .) (not applicable to incidental nonferrous metal).* When tested as in 4.2.6, type I minimum coating weight shall be 150 mg/sq ft (1600 mg/m²) for spray processes and 300 mg/sq ft (3.2 mg/m²) for dip processes Unless otherwise specified, the coating weight shall be tested at least every four hours.

[Amendment 1]

3.5.2 *Phosphate coating weight (Types I . . .) (not applicable to incidental nonferrous metal).* Coating weight shall be controlled or tested as in paragraph 4.2.6. Unless otherwise specified, the coating weight shall be tested at least every four hours. The following coating weights are applicable.

3.5.2.1 Type I covers three classifications (Class 1, Class 2A, and Class 2B). Class 1 is for spray processes and requires a minimum coating weight of 150 mg/sq ft. There are two classes for immersion or dip application. Class 2A calls for a coating weight of 300 ± 50 mg/sq ft while class 2B covers a coating weight range of 600 mg/sq ft to 1000 mg/sq ft (see 6.16.1).

[end of Amendment 1]

[Amendment 2]

3.5.2 Phosphate coating weight (Types I . . .) (not applicable to incidental nonferrous metal). Coating weight shall be controlled or tested as in paragraph 4.2.6. Unless otherwise specified the coating weight shall be tested at least every four hours (see 6.18). The following coating weights are applicable.

3.5.2.1 Type I zinc phosphate coatings. Type I covers zinc phosphate coatings. Type I coatings can be applied by spray, dip or immersion and permit a coatings weight which ranges from a minimum of 150 mg/sq ft for spray applications, to 300 mg/sq ft for immersion application to a maximum coating weight of 500 mg/sq ft.

[end of Amendment 2]

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4.2.2 Test Specimens. Test specimens shall be prepared from actual production items or parts thereof, or if size is prohibitive, from scrap parts of the same kind and finish (from the same manufacturing lot if possible) which have been rejected for causes other than phosphating, material composition, heat treatment or any combination thereof. Standard panels may be used when authorized by the contracting officer. Specimens need not be identical in shape or size but shall be . . . indelibly marked for identification as a test specimen. Standard panels, when used, shall be not less than 3 by 6 inches in size. . . . All test specimens of standard panels shall be processed through all cleaning, phosphating, painting, and drying steps along with the items being processed. . . . All test specimens of standard panels shall be processed through all the cleaning, phosphating, painting, and drying steps along with the items being processed.

....

4.2.6.1 Phosphate coating weight (types I . . .). Three test specimens (see 4.2.2), at the conclusion of a maximum of each 4 hours of phosphate processing shall be selected by the inspector for the test. The clean, dry specimens shall be accurately weighed and the surface area of each calculated. The phosphate coatings shall be completely removed by immersion in a 5 percent (by weight) chromic acid solution at 165°F for 15 minutes, rinsed, dried and weighed. This process shall be

continued until constant weight is attained. A new chromic acid solution shall be used for each repeat immersion. The coating weight shall be determined from the formula:

$$\text{Coating weight} = \frac{(\text{Initial weight in gms} - \text{Final weight in gms}) \times 144,000}{\text{Total surface area in square inches}}$$

(mg/ft²)

$$\text{g/m}^2 = \frac{(\text{Initial weight in grams} - \text{final weight in grams})}{\text{Total surface area in square inches}}$$

Four hours production shall be considered acceptable provided the average coating weight of the 3 specimens equals or exceeds the minimum coating weight required for the applicable type and not more than one sample falls below the minimum. The sample falling below the minimum shall be within 10 percent of the minimum requirement. If 2 or more specimens fail to comply with the minimum coating weight, the four hours production shall be reworked and corrective action taken until production is again acceptable. When determining the surface area of irregularly shaped objects, consideration and care should be taken to correctly determine the surface area of both the inner and outer surfaces of the test piece.

....

[Amendments 1, 2 deleted the below listed original formula]

$$\text{g/m}^2 = \frac{(\text{Initial weight in grams} - \text{final weight in grams})}{\text{Total surface area in square inches}}$$

[and replaced with the following]

$$\text{mg/sq m} = \frac{(\text{Initial weight in milligrams} - \text{final weight in milligrams})}{\text{Total surface area in square meters}}$$

6.5.1.1 *Type I*. The Army Materials and Mechanics Research Center is the agency responsible for Army preproduction approval. Unless otherwise specified, phosphatized test panels and technical information shall be submitted through the Contracting officer to: Army Materials and Mechanics Research Center

[Amendment 1]

6.5.1.1 *Type I*. The U.S. Army Materials Technology Laboratory (MTL) is the referee agency responsible for Army preproduction procedure approval and when requested by the procuring agency, phosphatized test panels and technical information shall be submitted through the contracting officer to: U.S. Army Materials Technology Laboratory. . . . When MTL is used as the referee laboratory, MTL requires prospective contractors to submit the following information:

a. Specification identification including revision letter and amendment if issued. Also indicate the classification for which preproduction procedure approval is requested.

. . . .

c. Detailed information shall be included in the proposed procedure with respect to chemicals and equipment used. The supplier's chemical product profile or technical data instructives for both make-up and the limiting/optimum operating condition shall be included for the purpose of formulation verification.

. . . .

g. Quality control procedures shall be included which will be used for monitoring each bath used within the procedure.

h. Coating weight requirements shall be specified and quality assurance control procedures shall be specified which will assure proper control.

. . . .

j. The contractor/subcontractor shall prepare six (preferably 3 inch x 6 inch) phosphatized panels for the procuring agency or designated laboratory . . . using the proposed phosphate coating procedure designated for use in contract and shall indicate the test results of three representative panels (coating weights) tested in accordance with paragraph 4.2.6.1. . . .

[end of Amendment 1]

[Amendment 2]

6.5.1.1 Army preproduction procedure approval for type I coatings. Coating procedures used in the application of type I zinc phosphate coatings must be approved prior to commencement of production. Prospective contractors are requested to furnish the following information:

[Amendment 2 ended with the above stated subparagraphs a through j. Subparagraph j was changed slightly without changing the basic substance.]

....

6.5.3 Procedure (method of application of phosphate coating) (applicable to type I only). The phosphate coating shall be applied in a minimum of five stages. Additional stages may be added at the option of the contractor provided that the five basic stages are retained. . . .

....

[New paragraph added by Amendment 1]

6.17 Existing documents and/or drawings. All existing documents and/or drawings which call for pretreatment per TT-C-490, types I . . . do not presently identify classification but future revisions should be updated to include appropriate classification.

[end of Amendment 1]

[Added by Amendment 2]

6.17 Existing documents and/or drawings. All existing documents and/or drawings which call for pretreatment per TT-C-490, types I . . . do not presently indicate the specific coating weight minimum weight requirements but future revisions should be updated to include the appropriate minimum requirement.

[end of Amendment 2]

....

10. Specification MIL-H-6875G, Amendment 2, HEAT TREATMENT OF STEEL, PROCESS FOR, dated 14 February 1986, provided as follows (AR4, tabs H-6, -8):

3.3.2 Steel shall, after final heat treatment, be hardness tested in accordance with 4.3.2.1. . . .

. . . .

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Control records. Records of furnace temperature surveys, calibration of control and recording instruments, types of furnace atmospheres and thermal process employed in heat treating specific parts or heats of steel shall be on file and available for review by contractors and Government representatives for five (5) years.

. . . .

4.3.2.1 Routine hardness test of heat treated parts made from classes A, B, and D steels. For routine quality control, all parts shall be tested for hardness after final heat treatment, except when such tests would be destructive or impractical to accomplish, as for example, if applied to the rolling elements of ball or roller bearings.

All of the quoted provisions except those from ¶ 3.3.2 and the title of ¶ 4.3.2.1. had not changed since the original MIL-H-6875G was issued 16 September 1983. The language from ¶ 3.3.2 and the title of ¶ 4.3.2.1 derived from amendment 1, dated 5 March 1985. (AR4, tabs H-6 to -8)

11. ADL 1380545, Revision A, dated 16 August 1988, NOMENCLATURE BOMB ASSY, BOMB, GENERAL PURPOSE, 500 POUND, MK-82 MOD 1, EMPTY made TT-C-490C and amendment 001, and MIL-H-6875G and amendment 002, applicable in the manufacture of the MK-82 bomb (R4, tab 2-6; AR4, L-3).

12. ADL 923AS116, revision A, dated 28 March 1988, NOMENCLATURE BOMB, BODY ASSY, EMPTY BDU-45/B stated TT-C-490C and amendment 001, and MIL-H-6875G and amendment 002, were applicable in the manufacture of the BDU-45/B bomb body (R4, tab 2-5; AR4, tabs L-5, L-6).

13. ADL 923AS651, dated 7 November 1987, stated TT-C-490C and amendment 001, and MIL-H-6875G and amendment 002, were applicable in the manufacture of the BDU-50A/B bomb body. (R4, tab 2-4; AR4, tab L-4)

14. ADL 923AS651, revision D, Change Notice 001, dated 29 April 1991, after contract award added at page 10 of ADL exceptions the following (R4, tab 2-4 at Bates page GGR1001929):

8. SPECIFICATION TT-C-490, AMENDMENT 2

A. IN LIEU OF TYPE I ZINC PHOSPHATE IMMERSION OR DIP APPLICATION (300 MG/SQ. FT. TO 500 MG/SQ. FT.) THE FOLLOWING APPLIES:

TO VERIFY PHOSPHATE COATING WEIGHT OF BOMB SURFACES, WEIGHT LIMITATIONS SHALL BE 200 TO 400 MG/SQ. FT. THE TEST PANELS SHALL BE SMOOTH MILL FINISHED.

B.^[6] IN THE CASE THAT THERE IS A QUESTION OF THE CLEANLINESS ON THE EXTERNAL NOSE SURFACE OF THE BOMB, A VISUAL STANDARD ESTABLISHED BY A GOVERNMENT REPRESENTATIVE WILL BE UTILIZED AS A COMPARATOR TO PASS OR FAIL THE BOMB.

15. AMCCOM's 10 August 1990 JUSTIFICATION REVIEW DOCUMENTS FOR OTHER THAN FULL AND OPEN COMPETITION (J&A) stated in pertinent part that it was seeking authorization to issue a request for proposal (RFP), restricted to Harley-Davidson, Inc. (H-D) and IMCO, for a firm fixed-price contract, maximum estimated value \$22,673,127.49, to produce 500 pound bomb bodies (MK-82, BDU-45 and BDU-50); that the 500 pound bomb body was a critical item for the Navy and Air Force; and the required capability to produce the 500 bomb body was not readily available from other manufacturers due to the large initial equipment needs and required specialized skills. A total of nine contracts for the MK-82 bomb bodies including BDU-45 and BDU-50 were competed and awarded to H-D, none to IMCO, from 28 February 1985 to present. IMCO last completed a MK-82 contract in December 1982. (AR4, tab B-7; finding 19 *infra*)

16. Mr. John Piercy, PMTC, in his 18 September 1990 pre-award survey, stated in pertinent part that IMCO experienced quality problems in past procurements; that IMCO was planning to use its MK-83 (1000-pound bomb) production line for forging, cutting, welding and heat treating the MK-82 500 pound bomb bodies and planned to purchase computerized numerical control (CNC) equipment for machining; but IMCO was unclear on the method it intended to use to machine the bomb body nose and base threads. Mr. Piercy's recommendation of "a negative finding for both production and quality" was based on his assessment that IMCO's commitment to quality was lacking over the past 10 years; IMCO neither identified the method to be used for thread machining nor the CNC manufacturer; and it was not apparent IMCO would be using properly trained CNC operators capable of interpreting or maintaining X bar and R charts. (AR4, tab E-4)

17. Mr. Phillip B. Laquey, IMCO's President and General Manager, stated in his 19 September 1990 letter to Mr. Joe Wells, Armament, Munitions and Chemical Command (AMSMC-PCA-W), that although IMCO realized that in prior years there were problems with its bomb body production line, major improvements have taken place over the past three or four months and the new vice president of operations, Mr. John Terranova, was fully dedicated to continue these improvements. IMCO's stated position was that it intended to machine the MK-82 bomb bodies in a completely different method than presently used on the MK-83 and MK-84 bomb lines and to produce the MK-82, BDU-45 and BDU-50 with new equipment, thereby, assuring conformance to all quality and delivery requirements. IMCO further stated it was fully committed to implementing SPC in accordance with the solicitation, including the capital investment required to implement the new method of production as well as total quality management. (AR4, tab A-6A)

CONTRACT C-1071

18. On 28 September 1990 AMCCOM awarded negotiated firm fixed-price supply Contract No. DAAA09-90-C-1071 (contract C-1071) to IMCO for the PRODUCTION QUANTITY WITH FIRST ARTICLE of the MK-82, BDU-50, and BDU-45 bomb bodies, at a total contract price of \$13,952,628.50 (finding 1 *supra*; tr. 2/8).

19. IMCO, prior to contract C-1071, last produced 81,000 MK-82 bomb bodies under a Navy contract performed and completed May through December 1982. After the completion of the May-December 1982 Navy contract and prior to the award of contract C-1071, IMCO was awarded five MK-83 and five MK-84 contracts some of which were with AMCCOM. Subsequent to IMCO's completion of the prior 1982 Navy contract the services executed a Single Management Agreement for the procurement of bombs through a mobilization base producer, the Army. Prior to contract C-1071 IMCO had no production experience with either the BDU-45 or BDU-50. IMCO, while manufacturing MK-82 bomb bodies for contract C-1071, was manufacturing MK-82, MK-83 and MK-84 bomb bodies under other contracts.⁷ (SR4, tab 6 (Bates pp. 3508-09), tabs 8, 17 (Bates p. 3797); AR4, tab N-6)

20. Mr. Terranova's involvement with IMCO's bid was to prepare documents for the corporate office identifying the true cost to produce the MK-82 bomb body concentrating most of his effort on the machining process, *i.e.*, the purchase of new CNC machinery and the procurement of raw material. Upon joining IMCO in January 1990 as vice president of operations, Mr. Terranova observed the machinery to be pretty worn and he was told by IMCO's president, Mr. Laquey, that there were problems with IMCO's product. For contract C-1071 IMCO purchased 1025 and 1028 steel from its suppliers, Stupp Corporation and Lone Star. Modified 1025, 1028 and 1035 steel pipe each had different amounts of carbon with manganese added which will significantly impact hardness achieved during the heat treatment process. IMCO did not have a dedicated furnace for the MK-82 bomb electing instead to institute a sharing plan where the MK-83 furnace would be changed-over to allow for the heat treatment of MK-82, BDU-45 and BDU-50 bomb bodies and changed back to accommodate MK-83 bomb bodies. Mr. Terranova testified, and we so find, it was IMCO's intention to purchase CNC equipment to ensure consistent machining of the bomb bodies. (Tr. 1/90-96, 125-27, 218-19, 3/27-29, 51-52; SR4, tab 8; AR4, tab D6; finding 16 *supra*)

21. Mr. Terranova testified, and we so find, IMCO purchased 20 foot long modified 1025⁸ steel pipe manufactured to meet specifications; that at the time he prepared his portion of IMCO's bid for contract C-1071 he determined the requirements for each bomb body were as stated in clause E-4 of the specifications, *i.e.*, that each bomb body was to be inspected and tested to the requirements on only the drawings and specifications referenced in clause E-4. Mr. Terranova further testified, and we so find, that while preparing the bid he found drawings 1380548 (Casing, Bomb Body), dealing with physical properties, and 2518492 (MK-80 Series G.P. Bombs, General Requirements), addressing heat treatment and physical properties of welds, to be confusing and contradictory but he made no inquiry for clarification until after contract award; that he relied on his employee's representation and he quoted the IMCO's bid on his belief that TT-C-490C was applicable without amendments. IMCO performed a "parent" metal test to see if the purchased steel met the drawing requirements of yield strength (YS) minimum, 70,000 pounds/square inch, ultimate tensile strength (UTS) minimum, 105,000 pounds/square inch, and minimum 16 percent elongation by sending a tensile coupon cut-out of the manufactured 1025 modified steel pipe through the production line. Mr. Terranova testified, and we so find, that he assumed that if the coupon met the drawing requirements then the shipment of pipe from which the coupon was cut was deemed acceptable. Neither Mr. Terranova nor Ms. Connie Story, IMCO's metallurgical lab technician,⁹ except to say it was carelessness, could explain why the test reports for the coupons tested prior to first article submittal stated 1029 vice 1025 pipe was being tested. (Tr. 1/89-90, 92-94, 99-105, 225-29, 259-64, 295, 307, 2/8-10, 19, 93-95, 160-61; AR4, tabs F2, F3, F4)

22. IMCO's next manufacturing process was to thicken and form (taper) the nose of each of the four bomb bodies cut from the modified pipe; the bomb body is cleaned; the aft adapter ring, which was purchased, is machined and welded to the aft end of the bomb body; the base plug attached; and the purchased lug inserts are welded on. The shaped bomb bodies are then set outside. (SR4, tabs 217, 451, at 10-11; exs. A-23, 24)¹⁰

23. Bomb bodies, subsequently brought back into IMCO's plant, are hung from the nose by a hanging lug and sent through the heat treat furnace. Mr. Terranova testified, and we so find, that during performance of contract C-1071 IMCO had difficulty with hardness variations which could be caused by "any of the parameters," *i.e.*, time and temperature, associated with the heat treat cycle including the steel used, uncontrolled quench media temperature, and use of a "unmapped" furnace. Ms. Story testified and we so find that during heat treatment MK-83 holding pins were used for the MK-82 bomb bodies but IMCO found that they had a negative effect on the uniformity and consistency of the MK-82 bomb bodies. During the heat treat cycle as had been its practice on prior contracts, IMCO hung six coupons from the bomb nose's hanging lug, three at the top and three at the bottom of the bomb body, subjecting the coupons to the production heat treat cycle being experienced at the top and bottom of the bomb body. The coupons were then tension tested to the drawing requirements of YS minimum 70,000 pounds/square inch, UTS minimum 105,000 pounds/square inch, and minimum 16 percent elongation. It is uncontested that the coupons, being smaller than the bomb body, would be harder resulting in higher test results than results expected to be achieved from the bomb body. IMCO's Laboratory Procedures (LP) 112A, revision 1, dated 21 May 1991 stated that if one coupon failed to meet the drawing requirements then the other two coupons from the area in which the failed coupon was taken must be tested and both must meet the drawing requirements to be acceptable. If both additional coupons failed, the day's heat treat was unacceptable. (AR4, tabs N-9, I-16, *I passim*; tr. 1/105-08, 119, 279-82, 2/12, 3/32-33, 194)

24. IMCO's bomb body run consisted of 26 bomb bodies. A bomb body, upon exiting from the heat treat furnace, is subjected to a quenching and tempering operation. Having been stored outside, the product is then sandblasted and sent to the machine shop where it is subjected to three machining operations including a drilling operation when the lug bolt holes are cut,¹¹ a push-pull test of the lugs, and a hydro test, *i.e.*, the bomb is filled with water and then pressurized to ensure there were no weld leaks. The bomb is then gauged for acceptance including, but not limited to, the inside and outside diameters, the lug holes and charge tube hole. After being gage checked the bomb is then introduced to phosphate coating, cleaning, and painting. IMCO's phosphate coating procedure was to comply with specification "TT-C-490C." IMCO elected the Type I application for the phosphate coating by dipping/immersing the bomb bodies. During the phosphating process the bomb body was subjected to five tanks as follows: alkaline cleaner; rinse water; zinc phosphate; rinse water; chromic acid rinse. After drying the bomb is assembled with charge

cases, miscellaneous hardware, and nose and base plug. (Tr. 1/106-16, 182, 2/40, 120-21; SR4, tabs 141, 217, 307; finding 9 *supra*)

25. On 9 and 12 October 1990 IMCO provided the Government with its Quality Assurance Program Plan (QAPP), SPC, Receiving Inspection Test Program (RITP), and Production Inspection Test Program (PITP) for CDRL items A003 (MK-82); A007 (BDU-45); and A009 (BDU-50). IMCO informed the Government the Inspection Test Plan (ITP) did not include IMCO's designed "gaging requirements for a few major characteristics [but] these will be forwarded . . . no later than October 22, 1990 as corrected pages for . . . review and inclusion in the ITP's." The PITP included the hanging coupon method of testing described above. (R4, tab 5; finding 23)

26. On 15 October 1990 the Commander, PMTC informed the Commander, U.S. Armament, Munitions and Chemical Command (AMSMC-PCA-WM) that IMCO's QAPP for contract C-1071 was disapproved due to non-conformance with AR-92 (AR4, tab B-8).

27. The Commander, PMTC in his 23 October 1990 letter to Commander, AMSMC-PCA-WM concurred in the 28 September 1990 award of contract C-1071 to IMCO based on IMCO's statement that for 500 pound bomb body production IMCO would purchase 2 CNC lathes; it would single point machine the bomb nose and base threads; it would use variable gaging on all bomb threads for SPC; it would assign fully qualified operators to the CNC lathes; and it would hire a quality manager exclusively for bomb manufacture. Commander, PMTC, however, expressed concern regarding IMCO's phosphating procedures stating the Army Material Technology Laboratory (AMTL), in conjunction with an investigation of the cause of why MK-83 bomb thermal coating performed in 1985-1986 exhibited a lack of adherence, during the pre-award survey found large amounts of white powder on some of the phosphated bomb bodies indicating improper phosphating; that AMTL documented finding undried bomb bodies picking up dirt and debris when placed on the assembly table; that a large number of primed bomb bodies were being stacked in the weather; that primers were scuffed and marred; and that bomb bodies were gouged to bare metal. (AR4, tab B-9; SR4, tab 106)

28. AMTL, responding to Commander, PMTC's 23 October 1990 letter to Commander, AMSMC-PCA-WM, while acknowledging it did detail possible causes for thermal coating failures noted on MK-83 bombs, stated it did not find that IMCO's inspection system did not detect improper phosphated bomb bodies; that IMCO's priming of a wet bomb body was a very rare occurrence, not requiring AMCCOM's attention; that Government witnesses to IMCO's bomb body testing procedure have never commented negatively on it; and it was difficult to criticize IMCO for handling practices; *i.e.*, storing bomb bodies in the weather, since that was no worse than the Government storing and shipping bomb bodies in railcars where they got marred and scuffed. (AR4, tab B-10)

29. At the 6 November 1990 post award quality assurance conference, held to discuss the quality aspects of the contract and allow IMCO the opportunity to discuss any concerns, IMCO was offered a no cost modification allowing the use of the larger phosphate coating range called out in amendment 2 of TT-C-490, *i.e.*, 300 mg/sq ft min - 500 mg/sq ft max, vice the tighter phosphate coating range, *i.e.*, 300 ± 50 mg/sq ft, of amendment 1 (SR4, tab 151; finding 9).

30. On 13 November 1990 IMCO was advised its QAPP was disapproved due to non-conformance with "AR-92." On 13 November 1990 IMCO, having been advised its ITPs had not been received, forwarded its PITP and RITP to Commander, Rock Island, Illinois (R4, tabs 5-2, 5-3, finding 25 *supra*).

31. On 15 November 1990 Mr. David Schwegler, the Government's PCO, informed IMCO its SPC plan was rejected because it failed to annotate every characteristic identified for SPC. The SPC characteristics portion of the plan indicate, in many instances, that initial limits have been established while the Government expects SPC to be fully implemented from the outset; training was not fully addressed; several major characteristics were not addressed; the plan did not contain specific implementation dates; and there was insufficient corporate commitment to implement SPC in a meaningful and timely manner (SR4, tab 220).

32. On 30 November 1990 the Commanding Officer, Naval Weapons Station (NWS), Seal Beach, informed the Defense Contract Management Command (DCMC), that IMCO's 15 October 1990 gauge design drawing submittals for the MK-82, BDU-45 and BDU-50 bomb bodies, were partially acceptable and partially required resubmission, change or additional information (R4, tab 5-1, 5-6).

33. On 3 December 1990 the PCO informed IMCO that its PITP and RITP for the MK-82, BDU-45 and BDU-50 were acceptable for implementation subject to IMCO identifying the type of measuring instruments to be used and IMCO furnishing a copy of their phosphating procedures (R4, tabs 5-5, 5-7).

34. Mr. Lonnie R. Thomas, the Government's Chief, Operations Branch O, in his 12 December 1990 PLANT VISIT REQUEST REPORT, requested an independent assessment be made of IMCO's phosphate coating process due to numerous customer concerns regarding field failure of its specification compliance in the manufacture of the 500, 1000 and 2000 pound bomb bodies. In the "ACTION TAKEN" and "RECOMMENDATION" portion of the report the Government's representative, Mr. "Ruell Owens," on 27 February 1991 stated (AR4, tab B-13):¹²

Coating problems continue to be a problem for each of the above referenced bombs. The first step in the application of the primer is a zinc phosphate dip. Amendment C to TTC-490

requires a phosphate coating, the minimum thickness of 300 mg per square foot. Amendment 1, a requirement for the 500 pound bombs, contains two coating thicknesses: 300+/- 50 mg. per square foot and 600-1000 mg per square foot. The contract fails to identify which thickness is required. The contractors [sic] ITP was lifted from existing ITP [sic] and required the basic requirement of the minimum 300 mg per square foot. When the ITP was approve [sic] by the buying activity, the contract was amended negating the contractual requirements. Amendment 2 required a phosphate coating of 300 to 500 mg per square foot. IMCO has been advised verbally to use amendment 2. This requirement has not been imposed as a contracturally [sic] requirement. The exact requirement remains an unknown.

RECOMMENDATIONS: The buying activity must identify what they want, in writing. Otherwise, the surface requirements are questionable.

35. On 13 December 1990 IMCO provided the Government with the following documents for contract C-1071: RITP; PITP; four IMCO LP - Process Controls, LP-100 through LP-103; and IMCO Operation Instruction - Phosphate Process Tanks (AR4, tab A-7).

36. On 19 December 1990 the Commander, PMTC, informed the Commander, AMSMC that under the contract IMCO was required to submit a single comprehensive QAPP in accordance with MIL-Q-9858 and AR-92; but that IMCO's submittals, which were submitted at different times and in a variety of sub-documents, make reviewing futile since each new document alters the results of the review already completed on earlier submittals. AMSMC requested that IMCO be required to submit a single comprehensive QAPP in accordance with the technical data package requirements. (AR4, tab B-14)

37. On 21 December 1990 the PCO informed IMCO that its RITP, revision 1, dated 7 December 1990 and its PITP, revision 1, dated 11 December 1990, were acceptable since no comments were received from PMTC on either the original plan or the revisions (R4, tab 5-12; AR4, tabs A-8, B-15).

38. On 9 January 1991 the PCO informed IMCO that its SPC plan, revision 3, and QAPP, Revision 2, were approved; that only the PCO, not the Quality Assurance Representative (QAR), has the authority to approve any reduction in inspections based on the SPC; that approval of reduced inspections will only be considered when adequate evidence is provided indicating the process is "in control" and producing conforming

material. The PCO in conclusion stated he believed that IMCO's product's quality would improve with the implementation of the SPC and QAPP. (R4, tab 5-14; SR4, tab 413)

39. On 30 January 1991 IMCO requested authorization to use "mill finished standard panels" in lieu of the "actual product" as test specimens for control for phosphate application as provided for in Federal Specification TT-C-490C, ¶ 4.2.2 (R4, tab 5-17; AR4, tab A-9; finding 9 *supra*).

40. The Chief, Sea, Air Munitions Branch (SAMB) by memorandum dated 6 February 1991 discussing IMCO's request to use standard panels, informed Commander, AMSMC-PCA-WM, that SAMB had always approved IMCO's request to use standard panels as test specimens for control of phosphate requirements. However, due to problems observed during recent Government visits to IMCO, *i.e.*, bomb bodies with smut and white powder passing IMCO's inspection, SAMB recommended against standard panels being used since they were not manufactured of the same material as the bomb bodies it was possible for them to give a different indication of the phosphate operation than is provided by the actual product. SAMB recommended that IMCO use panels cut from the actual pipe used in bomb body manufacture and would reevaluate this recommendation after three months production based on data compiled through IMCO's SPC and positive recommendations from PMTC and Defense Contract Management Area of Operation's (DCMAO) QAR. (AR4, tab B-16)

41. On 6 February 1991, the Commander, PMTC informed the Commander, AMSMC-PCA-WM that IMCO's QAPP, revision 2, was unacceptable. AMSMC stated that most of the plan was reworded restatements of what was stated in AR-92 and did not meet the definition in AR-92; that no specific inspection and test data were included as required by AR-92; and if followed IMCO's QAPP, revision 2, would result either in confusion or acceptance of a non-conforming product. AMSMC recommended that IMCO be required to re-integrate and correct the inspection documents to meet CDRL requirements. (R4, tab 5-19; AR4, tab B-16A)

42. On 8 February 1991 the PCO denied IMCO's 30 January 1991 request to use standard test panels for phosphate control. The PCO opined that standard panels were not manufactured of the same material as the bomb body tube and, therefore, it was possible they could give a different indication of the phosphate operation than that provided by the actual product. The PCO stated that consideration for future use of standard panels would be based on IMCO's SPC program data and the recommendations of the Government's technical, quality assurance, and quality management, personnel. IMCO was told to use panels cut from the actual pipe used in bomb body manufacture for phosphate process control. (R4, tab 5-22)

43. On 11 February 1991 IMCO's zinc phosphate chemical supplier, Oakite Products, Inc. (Oakite), informed IMCO after numerous laboratory tests it was determined

that IMCO would need more stringent controls than those presently in place on the 1000 and 2000 bomb line to meet the 300 to 500 mg/sq ft requirements for the 500 pound bomb contract. Oakite made the following recommendation for the 500 pound bomb line: IMCO consider using smooth standard test panels, allowed by TT-C-490, ¶ 4.2.2 when approved by the CO, because blasted panels have a greater surface from one panel to the next and would result in rejections; IMCO consider installing temperature controls, similar to those used on the 2000 pound line; IMCO consider installing a timer which would automatically turn burners on and off; IMCO consider using a pump to deliver the Oakite Cryscoat Cm to the zinc phosphate bath on a continuous basis instead of infrequent large additions; IMCO consider maintaining the lowest possible concentration for cleaner in stage one which would decrease the alkaline carry-over to the zinc phosphate bath which in turn would maintain a higher free acid and decrease sludging; and IMCO consider maintaining the iron content in the zinc phosphate bath within closer limits. (SR4, tab 436)

44. On 16 February 1991 IMCO again requested permission to use milled finished standard test panels for the phosphate process control and on 25 February 1991 the PCO denied IMCO's second request. IMCO was told that although the Government agreed that it may be difficult to process actual bomb body material, it was neither unduly difficult nor beyond the scope of MIL-C-490C; and panels should be cut from either actual bomb body material or excess bomb body pipe which had been sandblasted with the bomb body it was representing. (R4, tabs 5-24, 5-25; AR4, tabs A-11, B-17)

45. During the 20-22 March 1991 period IMCO presented for its first First Article Test (FAT) six completed units and four completed sets of parts for the BDU-45/B empty bomb. Upon completion of the FAT the submitted units were rejected due, in pertinent part, to the following: IMCO's SPC plan was not implemented as required by the contract; only two of eight purchase orders contained SPC requirements; IMCO took no action to verify that the charts indicated an "in control" operation; IMCO's inspectors did not follow their ITP during FAT; inspections were performed with unauthorized equipment; designated inspection equipment would not adequately measure the characteristic they were designed to measure; gauges were not identified by revision number; destructive testing performed on FAT samples indicated tensile strengths were as low as 89,519 psi vice the 105,000 psi required under the contract; operators had difficulty using gauges; IMCO did not have all required gauges available during the FAT; and gauge instructions for two complex IMCO gauges were not present. (AR4, tab E-6)

46. On 26 March 1991 the PCO, in his letter to IMCO discussing the 22 March 1991 FAT for the BDU-45 bomb bodies, noted that significant problems existed requiring resolution before production could be authorized. The PCO opined that IMCO's noted weaknesses were due in large part to inadequate procedures/documentation. The PCO listed IMCO's problems as: SPC plan requirements were not contained in six of the eight purchase orders placed for component parts; IMCO's inspectors did not follow the ITP during FAT; although IMCO's inspection records indicate the test panels exceed the

105,000 psi tensile strength, destructive tests performed on the FAT samples resulted in strength as low as 94,000 psi; non-compliance with the elongation requirements; IMCO did not have all the required gauges available for FAT; no gauge instruction was available for two complex IMCO gauges; and operators had difficulty using those gauges. (AR4, tab A-13)

47. On 10 April 1991 the AMTL issued its report regarding its observations made on 20 March 1991 while assisting PMTC in a First Article (FA) inspection of IMCO's MK-82 bomb body production process. AMTL's report of its findings stated in pertinent part that IMCO's tests on three coupons taken from BDU-50 bomb bodies, in accordance with Federal Test Method Standard Number 151A, resulted in all three specimens failing to meet the minimum strength requirements for yield and/or ultimate tensile stress; that the problem with IMCO's production procedure is that there was no correlation made between the strength of the bomb bodies and the strength of the coupon passed through the heat treat alongside the bomb bodies. (SR4, tab 307)

48. Mr. Al Ochoa, the Government's gauge project manager, in his 11 April 1991 trip report memorializing his observations of the 20-22 March 1991 FAT for contract C-1071, stated six components failed to meet the dimensional characteristics per the drawing; the ITP required re-writing because of the many discrepancies between what the ITP stated was to be used, and what IMCO's inspectors used, to verify characteristics; and several minor gauge designs must be re-designed because the gauges did not properly verify characteristics. Mr. Ochoa stated the Government's FAT team recommended the FAT be disapproved and a completely new FAT be conducted. (AR4, tab B-26)

49. Mr. Terranova testified, and we so find, that when preparing IMCO's bid he understood the procedure for acceptance testing was to be the hanging coupon; and he did not contemplate destroying a bomb body by cutting it to get a tensile coupon because he never contemplated the entire bomb body having to meet the material properties of 70,000 KSI yield strength, 105,000 KSI tensile strength and 16 percent elongation in 2 inches; that he was told at the pre-FA meeting for the first time that a coupon was to be taken from a bomb body; that bomb body coupon results when tested were somewhat lower than what was achieved from the tensile coupon tested in preparation of FA testing; and he concurred in this since he had concluded that the bomb body would not meet the coupon's tensile requirements because of the variance in the thickness of the two. (Tr. 1/121-23, 151-53, 322-24)

50. Mr. Douglas A. Stolk, P.E. Metallurgical Consultant, Metallurgical Engineering Services, Inc. (MES) was contracted by Mr. Terranova to assist IMCO in obtaining mechanical properties in the MK-82 bomb body. Mr. Stolk testified, and we so find, that his report was a study to identify what was causing IMCO to achieve low tensile strength results. Mr. Stolk reported to IMCO in a 29 April 1991 report addressing MES's metallurgical analysis of MK-82 casing tensile properties that the major cause for the low

tensile properties of the cut bomb coupons was slow cooling during the quench cycle. A second cause, identified as possibly the major factor, for the test specimen's failure to meet the required minimum values was the prevalence of aluminum oxide impurities and microvoids in the steel itself. MES suggested overcoming the impurities factor by increasing the stress rate during tensile testing which would possibly succeed in preventing microvoids coalescence and associated micro-cracking ahead of the advancing fracture front. Mr. Stolk's suggestion for overcoming marginal tensile properties caused by slow quenching and the resulting soft high temperature transformation product was for IMCO to: use a closed quenching system and add a commercial quenching compound for increased quenching power; increase agitation and decrease temperature of quench water; cut transfer time from hot furnace to quench tank; increase volume of flow of quench through the bomb casing; avoid surface dirt and scale on the bomb body; and use a bomb hanger that allows increased water flow through the bomb body. Mr. Stolk opined that as long as the material met the mechanical properties specified in the governing drawing the strength of the bomb body was immaterial. (SR4, tab 105; AR4, tab F-7; tr. 3/46-47, 59-61, 202-11, 224-26, 270; finding 4 *supra*)

51. IMCO, from 30 April through 3 May 1991, conducted its second FAT. Upon completion of the test the FAT units were rejected due in pertinent part to the following: tensile testing of three coupons cut from three bomb bodies failed to meet minimum mechanical properties specified in the governing drawing; gauges were not available or could not be found; IMCO's ITP was inconsistent, *i.e.*, it did not include some designs called out in the specification and drawings; calibration program did not meet MIL-STD-45662; calibration records were calibrated on non-existing gauges; and gauges for major characteristics had been physically changed since design approval. (SR4, tab 218)

52. The written summary of the 3 May 1991 outbriefing meeting, attended by IMCO's and Government's representatives, reported the following was discussed: a significant number of problems resulted from IMCO using unapproved drawings; coupons cut from the bomb body failed to meet minimum mechanical properties specified by the governing drawing requirements; gauges needed either calibration/record updating or were not available; and the ITP needed to be made consistent with actual gages and procedures. Mr. Terranova was reported to state, and we so find, that a good portion of the hanging coupons, as recorded in the 26 April 1991 tensile test results, failed elongation and IMCO was working on bringing them up; and that IMCO believed it had complied with every aspect of the contract and the tensile strength was a concern. Mr. Terranova testified, and we so find, that at the time of the second FAT failure IMCO was not ready, that IMCO had a statistical process control problem as well as problems with controlling gauges, *i.e.*, the gauge logs were not being properly maintained. (SR4, tab 99; tr. 1/246-47)

53. Mr. Gary Smith, the Government's product quality manager, in his 6 May 1991 memorandum to Director, AMSMC, delineating his observations made at IMCO's second

FAT, stated the second FAT was rejected because IMCO's quality assurance plan was unacceptable due in pertinent part to inadequate methods of inspection which, since the first FAT, IMCO made little progress in correcting; gauges were being used without gauge design approval; approved gages were not resubmitted for acceptance after being physically changed; specific characteristics were not verified by the gauges being used; gauge calibrations were not being recorded; gauges reported destroyed were also reported as being calibrated; and coupons cut from the FAT samples failed the drawing tensile requirements. (AR4, tab G-8)

54. The Government's position, in pertinent part, as stated in its 6 May 1991 written narrative of its DISCUSSION OF TENSILE STRENGTH BDU-45 BOMB BODY, CONTRACT DAAA09-90-C-1071,¹³ was that at the first FAT when IMCO conducted tensile strength tests on coupons cut from the actual FA bomb body units they failed although IMCO certified that the standard coupons passed the tensile strength tests. The narrative further stated that IMCO reported, during the period between the first and second FATs, that problems were experienced trying to reach the proper tensile strength and that a metallurgist reported that due to the type of steel IMCO purchased, an ultimate tensile strength of 105,000 "was very difficult to achieve." At the second FAT coupons were again cut from the submitted FAT units and tested against the contract requirements. Of the first series of coupons tested, two failed yield and ultimate requirements and one failed elongation. Of a second series of coupons, one failed the yield and ultimate test, one was a no test, one failed the elongation, and one passed. IMCO argued the testing of bomb bodies was not a contract requirement since the specification for tensile strength testing stated coupons could be used; that testing of the actual bomb bodies had not been a requirement in previous Government contracts for the same or similar items; and since the standard coupons passed the test, the bomb bodies were contractually acceptable regardless of whether or not they meet the drawing requirements. (AR4, tab B-27A)

55. Mr. Stolk, in his 6 May 1991 report to IMCO summarizing his findings on the Tensile Properties of MK-82 Samples, stated he concluded from his evaluation and interpretation of Specification MIL-H-6875H that there was no provision for cutting test coupons from actual parts given the minimum strength levels required by the MK-82 blueprints; that single tensile coupons hung on each furnace charge of bombs was the appropriate method of determining tensile strength; and only in the case of a dispute in the hardness tests should tensile specimens be made. Mr. Stolk however, testified, and we so find, that he never reviewed the contract; he was not aware if revision G or H of MIL-H-6875 was applicable although revision H was cited in his report; and he determined that, as written, the contract did not require the end product, the bomb body to have any tensile strength at all. (AR4, tab F-8; tr. 3/96-97, 268-71)

56. On 10 May 1991 the PCO, discussing the unsatisfactory heat treatment of MK-84 bomb bodies under Contract No. DAAA09-89-C-0158,¹⁴ informed IMCO that

although the use of coupons as verification of tensile strength was not prohibited, IMCO's method of inspection did not assure results from the coupons as having a correlation to the mechanical properties of the bomb body (70,000 psi yield, 105,000 psi ultimate tensile, and 16 percent minimum elongation). IMCO was told to submit, by 24 May 1991, a method of inspection that would assure conforming products were being produced. (R4, tab 5-34)

57. On 16 May 1991 the PCO informed IMCO it failed the second FAT due to major systemic problems with IMCO's quality system as well as dimensional and procedural problems. The PCO stated the coupons cut from the FAT units failed to test to 70,000 psi minimum strength yield, 105,000 psi ultimate tensile strength, and 16 percent minimum elongation; that IMCO used inadequate inspection methods, *i.e.*, gauges were used without design approval; approved gauges had been physically changed without being resubmitted for acceptance; gauges being used did not verify the specified characteristics; the record card for a 13 inch gauge, scrapped months ago, indicated the gage was still being used to verify specified characteristics; and dimensional conformance to requirements was not verifiable. IMCO, during the second FAT, was found to have used an inadequate calibration program, *i.e.*, a program which did not comply with MIL-STD-45662; "GO" and "NO GO" thread gauges' records revealed no dimensional changes in as many as 42 consecutive months; a scrapped go gauge was listed on the record card as being used. The PCO, addressing a failure of communication between IMCO's first line supervisors and IMCO management, stated written procedures did not reflect actual work methods and subsequent noncompliance with those procedures; and there was a lack of quality control over drawings, equipment, and procedures, including inadequate inspection methods, for assuring the mechanical properties for the bomb bodies are achieved. The PCO stated the use of coupons was not prohibited but IMCO was responsible for assuring the results obtained therefrom correlate to the mechanical properties along the entire length of the bomb body. Due to the inconsistencies between the ITP and the actual method of inspection the ITP was rejected. (R4, tab 5-35)

58. Mr. Al Ochoa, the Government's gauge project manager, in his 17 May 1991 trip report describing his observations of the second FAT under contract C-1071, held 30 April - 3 May 1991, stated gauges were being used without gauge approval; some approved gauges had been physically changed and not resubmitted for re-approval; minor gauges were being used that did not verify specified minor characteristics properly; calibration program did not comply with MIL-STD-45662; records of a "GO" thread gauge revealed no dimensional changes in as many as 42 consecutive months; records of a "NO-GO" thread gauge showed no dimensional change for 35 months; recorded destroyed gauges were still being used; and coupons cut from FAT units failed the tensile strength. Mr. Ochoa stated the attendees' recommendation was that all methods of inspection (MOI) be resubmitted to alleviate the confusion stemming from IMCO's adding/replacing/rescinding/combining MOI without informing, coordinating or obtaining Government approval. (AR4, tab B-27)

59. In his 17 May 1991 memorandum to the Commander, AMSMC-PCA-WM the Commander, PMTC, discussing the second FAT under contract C-1071 held 30 April through 3 May 1991 stated the first FAT, held 20 - 22 March 1991, failed because of dimensional non-conformance; inadequate physical properties of bomb bodies; lack of compliance with SPC, inspection and test plans; and lack of gauge/approval methods of inspection. The second FAT failed, in pertinent part, because gauges without design approval were being used; use of gauges that did not verify the specified characteristics; IMCO's calibration program did not comply with MIL-STD-45662, *i.e.*, the records were not updated and reported destroyed gauges were still being used; coupons cut from FAT items failed tension testing; and the inspection and test plans were inadequate. It was PMTC's contention that although MIL-H-6875 revision G does not mention the use of attached coupons, contract paragraph 4.3.2.1 requires all parts to be hardness tested after heat treatment; that the minimum hardness readings should correlate with the bomb's minimum tensile requirements; that in accordance with the drawings, verification of the actual physical property requirements of the bomb body must be accomplished by tension testing coupons cut from heat treated bombs. (AR4, tabs B-20, B-21A; SR4, tab 100)

60. On 29 May 1991 the CO, NWAC, informed DCMC QAR and IMCO, that the Navy Gage and Standards Center (NGSC) was suspending current review and approval of IMCO's inspection methods for all critical and major characteristics because of the Government's requirement, resulting from the second FAT failure, that IMCO resubmit for review and approval its inspection methods (R4, tab 5-37).

61. On 12 June 1991 IMCO's President, Mr. Laquey, informed the Government that based on the detailed findings of the second FAT "considerable corrective actions were undertaken to rectify all known non-conformance areas." Mr. Laquey listed, in pertinent part, the following as corrective action taken: all thread and plug gauges for the 500 pound bomb series have been re-calibrated and actual dimensions recorded on new record cards; installation of a computer software system to replace the manual card system was started; gauges have been reviewed for functionality and accuracy; currently 100 percent gauge calibration is underway; the RITPs and PITPs have been revised to include gauge instructions, all gauges are being identified with current revision levels and reflected in the updated ITPs including where used; production and receiving inspectors are being trained in the proper use of the ITP and relative gauges; and in preparation for the next FAT several mechanical property tests are being conducted to correlate tensile results of hanging coupons to actual Rockwell hardness conversion taken at various points on the bomb body. (AR4, tab A-17; SR4, tab 101)

62. On 16-19 July 1991 the third FAT was conducted using IMCO produced BDU-45/B Bomb Bodies. In the 19 July Government outbriefing memorandum it was stated that although IMCO did not correct a number of discrepancies found during the prior FATs, there was sufficient substantial performance shown to approve the FAT on the condition the discrepancies noted would be corrected (SR4, tab 122; AR4, tabs E-9, E-10).

63. Mr. Stolk, IMCO's metallurgical consultant, in his 22 July 1991 report on the Metallurgical Evaluation of MK-82 Steel Bomb, the acknowledged main thrust of which focused on a repeatable correlation between coupons and actual bomb body hardness, stated it was demonstrable that soft bomb bodies are merely a result of either heat-treatment variations or surface preparation variations for hardness testing and IMCO must consider including a valid test procedure to continually verify the correlation between coupon pulls plus hardness tests and actual bomb body results. Mr. Stolk determined that a tensile specimen which broke in the shoulder region vice the middle during elongation testing was probably due to the presence of aluminum oxide, which he found was two to four times the aluminum impurity content as compared to phosphorus and sulfur levels respectively. (SR4, tab 178)

64. Mr. Stolk stated in the observation, suggestion, and summary portions of his 22 July 1991 report that the reduction of the "tramp element contents" of IMCO's steel would result in higher strength and elongation values, but would increase material costs; that since window coupons were more representative of bomb properties than hanging (wire cluster) coupons the improved hanging fixtures made from scrap bombs should be continued; that given sufficient quenching power in the production quench tank, the MK-82 steel bomb body would consistently respond to heat treatment sufficiently to achieve minimum UTS and YS; that the current strength spread of 35,000 psi between UTS and YS is abnormally high and would better reflect industry standards if reduced to 20,000 psi; at the given furnace cycle times no benefit is gained from hanging bombs singularly; data from the traditional wire-hung coupon were not correlatable with bomb surface due to random positioning of the coupon against the accompanying bomb body; and actual tensile strength values of the bomb bodies themselves were well-correlated with window coupons but elongation values were not predictable due to additional variables, *i.e.*, residual elements and inclusion distributions, not yet defined. Mr. Stolk testified, and we so find, that unclean steel was found when he performed his inclusion count and that he recommended to IMCO to use a cleaner steel with higher carbon content. (*Id.*; AR4, tabs F-7, F-10; tr. 3/219-25, 238)

65. Mr. Al Ochoa in his 16-19 July 1991 trip report to IMCO, dated 21 August 1991, to observe the third FAT for contract C-1071, stated the following major problems were observed: inadequate MOI, inadequate calibration program, and inadequate tensile strength. Mr. Ochoa stated IMCO was observed to use inspections without approval from NGSD/DCMAO, minor gauges were used that did not properly verify specified minor characteristics; approximately 7 gauge designs need to be redesigned; calibration program did not comply with MIL-STD-45662.25; due to inadequate certification gauge hardware needed to be recertified; and 2 of the 10 bomb bodies processed through heat treat and selected for tensile and elongation testing failed elongation. Mr. Ochoa stated the consensus of those observing the third FAT was that the test was held prematurely since

many of the same things wrong with the first and second FAT had yet to be corrected. (AR4, tab B-28)

66. On 23 July 1991 the Government informed IMCO that “based on the results of [the third FAT, 16-19 July 1991, IMCO] is authorized to correct and proceed.” However, IMCO was advised that several areas of concern require immediate attention; that the enclosed findings from the third FAT combined with IMCO’s notes and findings may hasten corrective action; and “upon appropriate approvals allow commencement of production.” (AR4, tab A-18; SR4, tab 451)

67. The Government’s metallurgy/metallurgy welding expert, Mr. Robert Cargill, testified, in agreement with Mr. Stolk’s statements made in his 22 July 1991 report, and we so find, that IMCO’s delay in getting bomb bodies from the heating operation into the quench tank was critical to the hardening process; that the longer the delay in getting the red hot bomb body into the quench tank, the lower the achievable tensile strength will be; that the optimum time for the bomb body to travel from the furnace to the quench would be 10-seconds or less; and IMCO’s experience with meeting minimum tensile strength should have led them to lower the travel time from the furnace to the quench. Addressing hardness Mr. Cargill stated, and we so find, that machinability of the bomb body is done by the CNC machine which is set by a technician to machine a specific hardness; that once set the CNC will attempt to machine all bomb bodies the same; that due to an out of control quench the bomb body was not uniformly hardened; and that the varying hardness of the bomb bodies, some harder and some softer than the setting of the CNC machine, would result in CNC tooling breakage. (R4, tab 178; tr. 11/141-59 *passim*)

68. Mr. Cargill also agreed with statements made by IMCO’s metallurgist, Mr. Robert W. King, to IMCO’s Manager of Material, Ms. J. Stone, and we so find, that IMCO’s delay in getting the bomb body from the furnace to the quench caused scale build-up promoting an insulating coating restricting the quench operation and possibly causing erratic and non-uniform properties in the heat treated bomb. Mr. Cargill opined that scale build-ups acted as an insulator causing differential heat treatment effects for different parts of the bomb. Mr. Cargill also agreed with Mr. King’s conclusion the chemistry of the steel composition was a major factor in the results obtained with quench and tempering (Q&T) operations; that since the pipe furnished can be low or high side chemistry within the ordered range due to tramp metals and aluminum, control and adjustment of the Q&T operation is very important and therefore IMCO should know the actual chemistry of each lot being heat treated. (SR4, tab 168; tr. 11/161-69 *passim*)

69. On 25 July 1991 the PCO, confirming the clarification made regarding phosphating procedures applicable to contract C-1071, informed IMCO that bomb bodies should be phosphated in accordance with Military Specification TT-C-490C, amendment 2; that a contract modification is forthcoming; that under amendment 2 bomb bodies phosphated in a dip application are required to have between 300 mg/sq ft minimum and 500

mg/sq ft maximum coating thickness; and the authorization to use standard panels to assure proper phosphate coating weights was pending, awaiting IMCO's submission of data indicating that use of standard panels will assure that bomb bodies do not exceed maximum coating tolerances (SR4, tab 112; R4, tab 5-45).

70. On 30 and 31 July 1991, Mr. Ralph Wunder, Chief, SAMB, AMCCOM notified the Commanding Officers, Naval Warfare Assessment Center (NWAS), and Officer-In-Charge, NWS, Seal Beach, that under contract C-1071, NWAS was to review and approve the contractor's equipment designs for the inspection characteristics classified as critical or major; that they have been remiss in responding to IMCO concerning its method of inspection and gauges for three critical and three major characteristics; and this failure to respond may be construed as a Government-caused delay in production. Mr. Wunder recommended NWAC and NWS be more vigilant and take every initiate to assure the gauge designs are acceptable. (R4, tabs 5-46, 5-47)

71. IMCO on 15 August 1991 informed the Government that its laboratory technician, Ms. Story, having conducted phosphate coating tests on slick, sand blasted standard and bomb case material panels, reported that 300 to 500 mg/sq ft was achieved on 4 of the 7 panels tested. IMCO requested approval to produce product utilizing slick panels, verifying coating of 300 to 500 mg/sq. ft which would result in bomb casing coatings under 1000 mg/sq ft (R4, tab 5-50).

72. IMCO reported on 15 August 1991 having completed diameter inspection of 10 lots (150 bombs per lot) at 28 stations pursuant to MIL-STD-105, General Level II, and all of the 13 units randomly selected from each lot (130 bomb bodies) passed. Accordingly, IMCO requested that it be allowed to inspect one in ten casings and that inspections be limited to eight stations. (*Id.*)

73. IMCO reported on 15 August 1991 it had completed Rockwell "C" testing of 13 units selected from the initial heat treat lot (150 bomb bodies) and completed destructive testing on 2 units with the following results: Rockwell "C" ranged from a low of 32.0 to a high of 37.0; UTS (psi) ranged from a low of 146,000 to a high of 166,000; and for the 2 units destructively tested the yield strength was 87,740 and 88,822, the ultimate tensile strength was 116,411 and 115,384, and the elongation was 19 and 16.5 percent respectively; all within the values required in the contract. (*Id.*)

74. On 16 August 1991 the PCO, responding to IMCO's 15 August 1991 letter, provided the following (R4, tab 5-51). IMCO was authorized to use either slick panels, with achieved phosphate level being between 200 - 400 mg/sq ft and/or sandblasted panels, with achieved phosphate level being between 400 - 550 mg/sq ft to indicate an acceptable phosphate covering on the actual bomb body is achieved. If IMCO chooses to comply with the 300 - 500 mg/sq ft as required by TT-C-490C, amendment 2, actual bomb bodies panels must be used. Regarding diameter inspection, IMCO was authorized to utilize

MIL-STD-1235A, level CSP-2, but was strongly recommended to use a more frequent sampling interval (not greater than code letter E, 1/7) for the initial several weeks of production. IMCO was required to submit a request for deviation (RFD) before it could be authorized to limit inspection to eight stations. Lastly, complementing IMCO on the results of its heat treat tests which indicate an “in-control” process, the PCO requested the full test results for the ten bomb bodies tested during the third FAT be provided, including results of samples determined to be “no-test” due to inclusion etc.; and the actual data, not production parameters, the furnaces and quench bath temperatures and the quench bath salt concentration. (AR4, tab A-22; R4, tab 5-51)

75. On 27 August and 3 September 1991 IMCO submitted its RITP, revision 7, and PITP for contract C-1071 for the Government’s review and disposition (R4, tabs 5-54, 5-58).

76. Ms. Lisa Jones Hepner of DCMAO,¹⁵ testified, and we so find, that on 10 September 1991 during an audit of IMCO’s calibration lab she witnessed gauges in the gauge laboratory were not actually being calibrated although results were being transcribed onto the gauge record cards; and that all gauges had been calibrated on the same day. During her investigation of this anomaly Ms. Hepner was told by IMCO’s laboratory personnel, and we so find, that they were not actually performing the calibration, that when the laboratory personnel requested IMCO to approve overtime to perform the calibration the request was denied, that since the laboratory personnel did not have time to do the calibration they would “pencil-whip” the records, *i.e.*, fill out the card to make it look like the calibrations were done. IMCO, advised of Ms. Hepner’s findings, issued a “Method B,” a written corrective action explanation, of the discrepancy. (Tr. 9/35-40; findings 78, 82 *infra*)

77. In a 12 September 1991 internal memorandum, IMCO’s president, Mr. Laquey, informed all employees that effective immediately Mr. Wendell Goodson would assume full responsibility (1) as quality control manager (QCM) for all bomb production; (2) for the gauge laboratory and receiving inspection departments; and (3) will continue as SPC and total quality management (TQM) coordinator. In the same memorandum it was stated that Mr. Bill Recer was to continue as quality manager with responsibility for sheet metal and missile inspection including welding and metallurgical laboratory. (R4, tab 5-68)

78. Mr. Laquey in his 13 and 24 September 1991 response to Ms. Hepner’s allegation that IMCO laboratory personnel were “pencil whipping” the gauge calibration records/system acknowledged that IMCO laboratory personnel did not record calibration results on gauges in question as required by QCM, section 17, but, he contends, the cause of the deficiency was gauge laboratory personnel updating calibration record cards on inactive thread gauges designated for contracts other than MK-80 series bombs. Mr. Laquey indicated that specific action taken was to instruct laboratory personnel to re-calibrate each gauge and record the actual findings at the time of calibration on the gauge

record card; an independent gauge calibration service will be brought in to perform a verification of the accuracy of the gauge laboratory's finding; and a change in management, as indicated in his 12 September memorandum, had taken place. Mr. Laquey also indicated that each of the laboratory personnel will be instructed in the requirements of QCM, section 7, and MIL-STD-45662A; a three day suspension was given to the person responsible for failing to comply with QCM, section 7; the outside contractor's re-inspection is targeted for 30 September through 15 October, 1991; re-calibration of gages calibrated on 7 September will begin immediately, starting with all the gages issued to the floor, then all gages located in the calibration laboratory, and be completed by 29 September 1991; each employee will receive eight hours of class training consisting of gauge room practice and requirements of MIL-STD-45662A with a class each quarter for one year; and a survey format will be developed by 15 October and implemented by 1 November 1991. (R4, tabs 5-69, 5-73; SR4, tab 104)

79. On 20 September 1991 the PCO informed IMCO the PITP, revision 7, was acceptable for implementation subject to changes noted (R4, tab 5-72; finding 75 *supra*).

80. Mr. Laquey on 25 September 1991 was informed by the PCO that DCMAO personnel had reported several significant non-conformance procedures were observed, *i.e.*, the SPC had not been implemented on operations identified in IMCO's SPC plan; that IMCO's PITP, revision 7, has been rejected for numerous discrepancies, most of which had been identified when revision 6 was reviewed, the most significant of which was IMCO's failure to add the heat treat procedures and phosphating procedures to the plan; that before production will be accepted the missing procedures must be added; assure proper calibration of all gages; and IMCO's failure to make appropriate corrections to the PITP for BDU-50 and MK-82, as indicated by the comments provided on the BDU-50 PITP, revision 6 submittal. The Government gave no explanation reconciling its 20 September 1991 acceptance of PITP, revision 7 with its 25 September rejection. (R4, tab 5-74; finding 79 *supra*)

81. IMCO's zinc phosphate chemical supplier, Oakite, in a 27 September 1992 letter to IMCO reported that upon reviewing IMCO's phosphating procedure the following comments and recommendations were being made: due to the tight parameters, *i.e.*, temperature, time, solution control, required to consistently meet the strict coating weight requirements, it was imperative that IMCO (1) install thermostatic controls on all heated tanks; (2) a continuous feed pump be installed on each zinc phosphate tank; (3) low heat cleaner be tested as a possible replacement for #190, and (4) the "Procedure for Processing Bomb Bodies through Five Stage Zinc Phosphate Line" be published and implemented. The Oakite letter further stated (SR4, tab 156):

Coolant Trail - One of the mills and one of the lathes on the 500 pound line was chemically cleaned, sanitized and charged with Oakite Controllant 600SS (semi-synthetic) on Monday

and Tuesday. The insert life on the mill showed a drastic measurable improvement (from 20 bombs per inset to over 40 bombs). The results on the lathe were less conclusive because of the normally short tool life. However, the results were stated to be equal or better. We do have an undesirable situation on the lathe and that is the leaking into the coolant sump of 9160 (soluble oil/gear lube) through the steady rest thereby contaminating the 600SS and robbing it of some of its superior qualities. We ask that the steady rest lube be changed to a standard gear lube.

The 500 pound line hydrotester was cleaned and charged with Controllant 600SS on Friday morning. This change was necessary after our investigation on Wednesday of the solution (Maxim coolant) in the tester. We found the pH to be 7.3 (any pH below 8.5 is suspect) and were advised by the operators that a Sunday charge will start to become odorous by midweek and be very "ripe" by the end of the week. This is proof of bacterial growth, the result of which (in addition to operator discomfort) is premature rusting of metal surfaces. I believe the low pH/odors explains some of the periodic flash rusting we have encountered on the interior bomb surfaces. Oakite can control this rancidity/rust problem and probably extend the life of the Hydrotest solution (saving on time and disposal cost). We do, however, request that the other mill be cleaned, sanitized and charged with Controllant 600SS as soon as possible since the 2 mills "feed" the hydrotester. Mills charged with 600SS will be less contaminating to the tester solution.

82. Mr. Gary Smith, the Government's product quality manager on 27 September 1991 reported to the associate director, AMSMC-QA, that Ms. Hepner during her 10 September 1991 visit to IMCO to review its SPC, witnessed IMCO personnel recording gage calibration results although no actual calibration actions were ongoing and no written records of calibration results were present; that IMCO personnel when questioned by Ms. Hepner, stated they were simply copying the previous month's records and had not actually recalibrated any of the gages. The report further stated that IMCO had not yet implemented a meaningful SPC program on contract C-1071; that IMCO had still not properly corrected the errors in their quality program plan; that IMCO, noting the contract required a CSP-2 level inspection plan, described the less rigorous CSP-1 plan to its inspectors; the PITP was defective, in pertinent part, by authorizing a greater than allowable number of deficiencies before a lot process was rejected and it authorized a less than allowable sampling frequency. The report continuing stated that gauge calibration records were missing although the gauges were being used; production operators and quality control inspectors

were using gauges that had no calibration stickers; four month calibration interval gauges were scheduled for six-month recalibration; and historical gauge records of prior calibration results were not being maintained as required by MIL-STD-45662. (SR4, tab 134; tr. 9/35-37, 41-42; findings 76, 78, *supra*)

83. In a 30 September 1991 internal IMCO memorandum Mr. Goodson informed IMCO supervisors that the gauge laboratory was a restricted area and access was limited to “only company officers” and other designated company individuals although this was not standard procedure. The Government’s on-site inspectors were being denied access to the gauge laboratory assumedly because Ms. Hepner witnessed IMCO’s employees falsely certifying the gauge records. (R4, tab 5-75; tr. 9/40)¹⁶

84. On 30 September 1991 IMCO submitted its PITP stating the required changes identified by Mr. Gary Smith, AMSMC-QAM-I, are identified by document change form No. 18 and by revision 8; the rest of the submittal is PITP, revision 7 which will be upgraded and distributed upon completion of the entire task (R4, tab 5-76).

85. Mr. Terranova on 1 October 1991 responded to the PCO’s 25 September 1991 letter regarding production problems stating the initial implementation of the SPC with charting of all operations as outlined in the approved SPC had been completed; revision 7 of the PITP had been changed to incorporate the heat treat and phosphate procedures and submitted for review; appropriate corrections consistent with those provided on 20 September for BDU-45 will be incorporated into the PITPs for the BDU-50 and MK-82; and all gauges used in production, on all programs, have been calibrated. Mr. Terranova requested the Government accept “approximately” 300 bomb casings, which had been produced during the initial production start-up but prior to charting, for shipment against the contract. (R4, tab 5-77)

86. Mr. Lowry, acting chief, SAMB, in his 2 October 1991 internal memorandum to Commander, AMSMC-PCA-WW, stated that IMCO’s PITP, revision 8, had been reviewed and the repeatedly provided corrective action necessary to make the PITP acceptable had yet to be taken. Mr. Lowry opined that IMCO’s corrective actions were hastily and incompletely performed; that their failure to correct the errors was an indication they were incapable of developing an acceptable quality program plan. Mr. Lowry concluded by stating IMCO should be advised that an acceptable PITP was a contract requirement and the continual failure to provide one will result in the SAMB recommending contract termination. (R4, tab 5-78)

87. On 3 October 1991 the Commander, PMTC, recommended that the PCO, AMSMC-PCA-WW disapprove IMCO’s PITP, revision 7 and RITP, revision 7 for BDU-45 because of discrepancies (R4, tab 5-81).

88. On 4 October 1991 the PCO informed IMCO that a recent visit to its plant by a Government Product Quality Manager (PQM) revealed that the SPC had not been implemented on the phosphating operation; machine capability studies have not been performed on any operation in accordance with the written SPC plan; and operations have not been subjected to investigation for out of control conditions. Also discussed by the PCO was IMCO's refusal to initiate corrective action on out-of-control points unless these points are also out of specification; IMCO's refusal to calculate upper and lower control limits in accordance with the approved SPC plan; that the milestone chart within the SPC is incorrect because the "Cpk's" reflected for base plug and retainer have not been subjected to capability studies; the phosphate technicians have yet to receive SPC training although the chart implies all existing personnel were trained; and IMCO personnel could not answer questions about questionable charts submitted by Novatech. It was also noted that IMCO's PITP, revision 8, did not address all the deficiencies found when the Government reviewed revision 7; the eight characteristics identified during the third FAT requiring verification still require verification; gauge CF4902487-3 was not approved and as of 1 October 1991 no alternative method has been submitted; and no production would be accepted until the independent gauge audit is performed on site on gauges randomly selected by the auditor. (R4, tab 5-83)

89. IMCO's 4 October 1991 reply to the Government's Method B Corrective Action Request for IMCO's SPC plan stated, in pertinent part, the approved SPC plan was being followed as closely as possible with a standard set at zero for non-conformance; the SPC system in place was a good one in both documentation and in practice; and in the future IMCO would not deviate therefrom. In order to prevent a recurrence of mistakes IMCO indicated it would add to the training program a two hour class every six months for each SPC trained employee to correct mistakes detected in chart review in the first year of production; the errors in the specification's limits on the MK-82 SPC plan will be corrected and the changes presented to the Government for approval; and IMCO will conduct all SPC process capability studies in accordance with the approved SPC plan and will evaluate the employee's/quality engineer's calculation using only the Government's CASPR SPC Software System. (SR4, tab 40)

90. IMCO's 11 October 1991 letter to the PCO stated comments on the BDU-45 PITP, revision 8, have been incorporated and the changes are submitted for review and approval; that upon receipt of approval all changes will be incorporated into the approved version with the entire document advanced to revision 9 and reissued; anticipating acceptance of the BDU-45's PITP by 15 October 1991, the MK-82 version will be completed for submittal no later than 22 October 1991; the RITP is currently being changed to incorporate ten pages of comments received on 9 October 1991 with an anticipated 31 October completion of revision 8; that although RITP revisions will not be completed for several weeks, the planned changes will be incorporated into receiving inspection procedures immediately; and all gauges have been released to production with the exception of two which are being calibrated and will be released to production by 14 October 1991.

IMCO further indicated that by 15 October 1991 it would complete a serialization list of the 545 products produced without adequate SPC and upon completion of scrap items a list will be furnished identifying forecasted shippable units. (R4, tab 5-88)

91. Mr. Russ Stevick, IMCO's 500 pound bomb Heat Treat Committee Chairperson, in a 23 October 1991 internal memorandum to various IMCO personnel, with a request for immediate response, stated the following have "reached critical state": (1) pins for hanging bombs to be heat treated; (2) design and installation of guides to keep bottoms over the top of "Xmas tree" and to keep bombs from falling over in quench tank; (3) quench time has increased as a result of insufficient "hyd[rodynamic] volume" and needs to be remedied at once; (4) insulation needed on exit door of high heat furnace; (5) floor of high heat furnace needs attention; (6) repair exhaust fan above high heat furnace; (7) need way to cook pins at high heat furnace; and (8) need spare "Hyd[rodynamic]" hose at furnace for immediate installation. (R4, tab 41)

92. On 25 October 1991 the PCO informed IMCO that its PITP, revision 9, was approved, and as stated in Mr. Ralph Wunder's, Chief, SAMB, 21 October 1991 memorandum, it was expected that the plan, or applicable portions thereof, would be at every inspection station; that inspectors would be familiar with, and perform, inspections as indicated in the plan; and the equipment listed in the plan should be on-hand and used. Mr. Wunder opined, and IMCO was informed, that although the approval of the PITP was a "long and arduous process" the finished product is an excellent plan that, if followed, should assure the quality of IMCO's product. IMCO in October commenced production of MK-82 bomb bodies while negotiating a new delivery schedule with the CO. (R4, tabs 4, 5-97, 5-99)

93. IMCO president, Mr. Laquey, in his 8 November 1991 internal memorandum addressing the MK-80 series bomb production stated that although substantial quantities of MK-82 bomb bodies were being produced, "delays in processing, paperwork, gauging, etc." have resulted in most of the product remaining in the plant and not on the way to the customer. Mr. Laquey opined that the issue had become so serious that urgent additional measures needed to be taken. Accordingly, Mr. Ernie Guerri, an IMCO senior vice president, was put in charge of all bomb activity to oversee all IMCO functions involved with the manufacture of this product line. (R4, tab 5-103)

94. Mr. Stevick, in his 11 November 1991 internal memo to Mr. Terranova, the subject of which was "SOURCE OF PRODUCTION PROBLEMS," stated (SR4, tab 42):

Pipe

Stupp pipe is laced with tramp/trash elements and oxides. This effects elongation, UTS, and yield strength. The pipe is not sized after welding and lacks compressive strength. The alloying elements are always on the low side.

Presses

TIR out; die alignment corrected problem. Small nose diameters; finish die was discovered to have been made to standard dimensions instead of shrink dimensions. Shrink dimensions are necessary to correct for coefficient of thermal expansion (nose temperature is 2300°F. when forged). This change corrected the problem. Bulging or buckling of the case body, is caused by soft pipe. Cold working or sizing will increase the compressive strength of the pipe allowing the use of increased pressure at the presses.

Heat Treat

Constant furnace breakdowns have held down production (hydraulic leaks, pin breakage, and temperature variation) Quenching: Due to the low alloy steel used, and method of operation, the Rockwell “C” hardness is high on the outside, and extremely low on the inside of the casing. A higher alloy steel and violent agitation of the quench solution inside the bomb casing will promote more even hardness through the wall section. Then the case can be drawn back to a lower Rockwell “C” reading for easier machining.

Pipe Derived

Stupp pipe is laced with tramp/trash elements and oxides. This condition effects elongation, UTS, and yield. Consistent heat treat results are hard to obtain. This pipe is not sized after welding and is too soft to resist the pressure required for extruding and forging. Nearly every case bulges when formed, requiring a repress operation. The soft condition and large size (toward the maximum diameter) result in oversize diameters where the Ogive starts.

Chemical analysis shows the Kurver pipe to be clean and the new modified 1029 steel forges readily. The new die configuration has helped to ease or reduce forcing pressure and the Ogive has a more consistent curve to it.

Heat Treat

The temperature differential between the top and bottom of the austenitizing and draw furnace, and the temperature drop in the austenitizing furnace when the doors open, create problems getting consistent results in the test coupons.

Scale

Scale removal has created another problem. The scale is not being removed completely. Scale remaining on the casing is pressed into the surface by the dies. The result is a scale pocket or rough surface. A high pressure water (1000 psi) descaler is required. A clean (descaled) surface will have a smoother surface finish and reduce the wear on the dies.

95. On 18 November 1991 IMCO submitted a 12 November 1991 dated DD 1222, Request for and Results of Tests, whereon it reported that the third FA, with the exception of phosphate procedure, was completed; that all outstanding FA inspection requirements were completed the week of 28 October 1991; PITP, revision 9, for the BDU-45 has been approved; but the PITPs for the MK-82 and BDU-50, and the RITP have not been approved (R4, tab 5-109).

96. Mr. Laquey in his 22 November 1991 internal memorandum to Mr. Henry J. Peppers, director of IMCO's parent company Datron, the subject of which was "ACTION TO PROTECT PROFITS AND CASH FLOW 1991" stated layoffs would take effect 25 November 1991; furloughs would take place the period of 25 November 1991 to 1 January 1992; deferral of purchases was being analyzed; and where possible, all expenses would be reduced (SR4, tab 280).

97. On 24 November 1991 Ms. Hepner recommended that IMCO's PITP (BDU-45), revision 7, MK-82 bomb bodies be disapproved due to deficiencies found in the submittal during its review and a corrected PITP be submitted for approval prior to 24 December 1991 (R4, tab 5-111).

98. Mr. Peppers in his 8 January 1992 facsimile informed Datron/IMCO personnel that Datron had "relieved Phil Laquey of his position as President of IMCO"; that an active search was in progress for a replacement; and during the interim Mr. Guerri and he, Mr. Peppers, will be managing IMCO. No reason was given for why Mr. Laquey was being relieved. (SR4, tab 280)

99. In his 9 January 1992 IMCO internal memorandum, the subject of which was "500 # BOMB UPDATE," Mr. Pete Hitzemann stated, in pertinent part, that "currently [IMCO was] not in control of [its] process"; that four production line lathes have four different programs in them to produce the same part; that there was insufficient inventory resulting in a consistent lack of required drills and inserts; bomb production rate was slower than expected due to the use of compound tooling; and there was a need to purchase several pieces of equipment which would result in cost savings and a greater production of bombs at the end of the shift. Mr. Hitzemann's suggested remedies for IMCO problems at the 500 pound bomb line were (1) installation of edit key switches to prevent operators of the lathes

from tampering with the programs and the loading of a master program thereby establishing a standard to work from; (2) accomplish a sufficient inventory of required drills and inserts and expedite the ordering of perishable tooling; (3) reducing the lag time between requisition submittal and placing of order with vendor from 8 to 10 to 3 to 5 days; (4) require suppliers to maintain stock of IMCO's most frequently ordered items; (5) use of compound tooling, *i.e.*, evaluate multi-insert turning and boring heads, to reduce tool changes and rapid moves and increase bomb production; and (6) reduce production time and increase bomb production by purchasing up-dated equipment, *i.e.*, Monoset type tool grinding machine to regrind the Sandvik "Delta" drills thereby eliminating the time it takes to send the drills to California for regrinding, Renishaw Probe System to reduce the time needed for the Okuma mill operators to input heights, chip conveyors for the Mazak lathe and both Okuma mills eliminating the need for the operators to stop the machinery to remove the chips. (SR4, tab 45)

100. IMCO in its February 1992 Production Progress Report stated it prepared and presented its FA in March 1991; that the Government changed the scope of the contract by requiring IMCO to cut tensile coupons from bomb bodies; that the Government would not accept the FA until the coupons met the specific requirements listed on drawing Nos. 923AS183B, 1380548M and 1252606H; and that a heat treat program ensued which caused a five month slip in production start up (R4, tab 4; findings 4, 7).

101. On 10 February 1992 the PCO informed DCMAO-Dallas, that IMCO lots 002 and 003 each lot containing 480 MK-82 bomb bodies produced under contract C-1071 were found to have major and minor defects during initial receipt inspection. DCMAO was asked to coordinate an investigation into the reported defects/deficiencies and report back the findings as to the root cause of the defects; corrective action taken by IMCO to prevent recurrence of the observed defects; and IMCO's position as to the repair/replacement of the defective items. (R4, tab 5-116)

102. Mr. Peppers in his 28 February 1992 facsimile regarding "MK-82 SECOND CONTRACT DAAAO9-91-C-0572 IMCO SHOP ORDER #32000," informed IMCO (SR4, tab 280):

We are contemplating the financial consequences of performance on the second MK-82 contract. Our financial experience on the first contract [C-1071] is expected to result in a loss of over \$5 million, and we feel that extending that loss will not benefit any future interest.

Until specific approval to begin work on the second contract is received from me, please do not incur any costs, allocate any items, or ship any product related to the referenced contract.

103. In a 5 March 1992 memorandum Mr. Randolph Stec and Melvin Brown, the Government's product quality inspectors, reported that during an evaluation of IMCO's SPC program the following were observed and/or discussed with IMCO's personnel: SPC charts were on the production floor but none were being used to reduce variability or to record action taken by the machine operators regarding machine adjustments, tool changes, shift changes, etc.; control limits had not been recomputed since the original capability studies were initially performed in the "Oct-Nov 91" time frame; of the 24 charts on the production floor, 8 have no control limits because capability studies were never performed, 9 are being used that have control limits set at 80 percent of the drawing tolerance, and the remaining 7 charts indicate that the process has shifted since the capability studies had been performed; IMCO was not conducting an adequate review of the SPC charts provided by their vendors; and current SPC charts for the MK-82 state that only 10 percent of the charts will be audited. Messrs. Stec and Brown recommended that IMCO, to achieve in-control processes, recompute control limits and "Cpk" values until they stabilize; perform new capability studies for those processes which indicate a shift had occurred; annotate control charts with all actions which affect the process. (SR4, tab 223)

104. On 12 March 1992 Mr. Stolk informed IMCO that x-ray analysis of four corrosion samples taken from three black pitted areas of machined MK-82 bombs and from an as-received pipe section confirmed the pitting in the machined bomb surface was composed of iron-oxide, the origin of which is "severe environmental corrosion of the pipe sections which developed during storage in the elements" (SR4, tab 311).

105. On 30 March 1992 IMCO, in a letter to the Government discussing the de-scaling requirements of the MK-80 series bomb bodies, stated the only requirement for scale removal was in TT-C-490 which states visible evidence of scale must not be present after cleaning and prior to phosphate coating. It was IMCO's position that encountered scale was (a) loose scale removable with shop compressed air, cloth, brush, or like means; (b) attached scale removable with shot blasting; and (c) embedded scale tightly trapped in the bomb's surface and not removable by any of the cited means. IMCO proposed removal of loose and attached scale on surfaces to be painted and/or removal of loose scale only on bomb surfaces that either require no organic finish or an asphaltic coating (not paint). The Government responded that this had been proposed in a earlier Engineering Change Proposal (ECP) and rejected. (R4, tabs 5-118, 445)

106. Mr. Peppers in his 1 April 1992 facsimile informed all parties concerned that Mr. Donald J. Steppe had "joined Datron as President and General Manager of [IMCO]" (SR4, tab 280).

107. On 3 April 1992 IMCO submitted an RFD to change the phosphate coating weight limits on test panels required by TT-C-490 from 300-500 mg/sf to 300-600 mg/sf when deposited on a shot or sand blasted panel which the Government on 16 April 1992 approved (SR4, tab 234).

108. On 26 May 1992 IMCO filed with the Government a Request for Equitable Adjustment (REA) in the amount of \$7,574,993¹⁷ alleging in pertinent part that IMCO incurred increased contract costs due to (1) Government-caused changes, delaying and disrupting IMCO's performance of the contract's heat treat requirement, attributable to the Government's requirement that IMCO conduct destructive testing of processed bomb bodies and demonstrate correlation between standard coupon specimens and coupons cut from the bomb bodies; and (2) the Government's imposition of a defective specification which changed the phosphate requirement of the contract requiring IMCO to utilize test specimens made of bomb body material instead of standard test panels which had been approved and successfully utilized on all prior bomb body contracts. The two original contract requirements allegedly changed and the subject of the EA claim were as follows. (1) Heat treatment requirement: IMCO contends it contemplated using bomb material samples, *i.e.*, hanging coupons made from the same material as the actual bomb bodies, to verify that the heat treatment process resulted in compliant bomb bodies that met the mechanical properties of yield strength of 70,000 pounds per square inch, tensile strength of 105,000 pounds per square inch, and 16 percent elongation in 2 inches; that the Government, as part of FA verification, tested samples of actual bomb body coupons; that the Government acknowledged that the use of material coupons was not prohibited; that the bomb body coupons did not meet all of the metallurgical requirements of the contract; that the Government did not officially reject IMCO's FAT but imposed a new destructive testing requirement into the contract by requiring IMCO to establish a correlation between sample coupons and specimens cut from actual bomb bodies. IMCO contends this alleged change caused it to conduct unanticipated research and development effort to its heat treatment procedures in order to produce correlation data not required by the contract and significantly delayed contract performance. (2) Phosphate requirement: IMCO contends as awarded the contract contained maximum and minimum allowances for zinc phosphate coating; that the specifications permitted the use of standard panels when authorized by the CO; that based on 20 years of long standing prior course of dealing IMCO bid the contract in reliance on continued use and approval of standard test panels; that after award IMCO was directed to use material cut from the actual bomb material instead of test panels; that IMCO's request to use standard panels was denied; that the use of bomb body material was more expensive; and the measuring equipment sensitive enough to measure weight variations ranging between 300 mg/sq ft and 500 mg/sq ft on steel bomb body samples was beyond the state of the art. (R4, tab 6; findings 4, 7 *supra*)

109. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - MAY 1992, dated 11 June 1992, to Mr. Peppers. In the report he stated that May's production and shipment were 63 percent below plan; that the MK-82 program continued to be IMCO's major problem area; that the bottleneck continues to be the sandblast area; and that a combination of poor equipment availability and changing quality requirements had devastated product flow. Mr. Steppe indicated the replacement of the sandblast cabinets and

a process modification for the quality issue, which had proven to be successful, would result in an improvement of production and shipment for June. (SR4, tab 283)

110. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - JUNE 1992, dated 14 July 1992 to Mr. Peppers, wherein he stated that the MK-82 program was still the major problem area; that bomb body shipments remained 53 percent below planned levels; that revenue shortfall was caused in part by below planned shipments of MK-82 bomb bodies due to production limitations and below planned sheet metal shipments due to lack of purchase orders; that progress in defining workmanship characteristics for product acceptance was made; improvements in process control are expected to yield major improvements in product recovery as well as total production in July; and the replacement of the sand blast cabinets continued to progress and was scheduled for completion in late July (SR4, tab 285).

111. In a 2 June 1992 internal memorandum IMCO personnel made the determination, based on an examination made by IMCO's zinc phosphate chemical supplier, Oakite, that the white stains found on the underside of the lugs resulted from composition of metal and variation in metal surface resulting from shot blasting and, accordingly, the bomb bodies with this anomaly were acceptable (SR4, tabs 143, 446).

112. In her 18 June 1992 inter-office memorandum Ms. Story informed Mr. Terranova that LP-112A had been revised to omit the hanging coupon. Ms. Story stated the elimination of the hanging coupon could save IMCO a "sizable amount of money" by eliminating scrapping out a piece of pipe from each bomb line; this elimination recoups the 2-manhours it takes to cut out the coupons and the 1.5-manhours needed to prepare the coupons for heat treat; allows for 2 additional production bombs vice the coupons to be heat treated; and the 2.5-manhours used to prepare and test coupons are recouped. In place of coupons Ms. Story suggested hardness be tested using a Equotip Hardness Tester and then converting the readings to a Rockwell "C" reading. (SR4, tab 421)

113. On 23 June 1992 IMCO informed DCMAO that LP-112A, revision 3, eliminated hanging coupons from the heat treat process; that hardness testing and the cutting of a coupon out of a bomb would verify the tensile, yield and elongation requirements of the bombs going through heat treatment (SR4, tab 421).

114. On 30 June 1992 the PCO informed IMCO that its PITP for MK-82 bomb bodies, revision 8, had been reviewed and "conditionally approved" subject to IMCO correcting "some minor deficiencies" still existing. IMCO was told that final approval was delegated to the Government's QAR upon verification that all necessary changes had been made. IMCO was to furnish a final revision of the plan to the appropriate offices. The PCO further stated that the comments on the MK-82's PITP were applicable to BDU-45's PITP; that although this PITP was approved 25 October 1991, the necessary changes should be incorporated prior to the start of production of this item. (R4, tab 5-122)

115. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - JULY 1992, dated 13 August 1992, to Mr. Peppers wherein he stated that the MK-82 program continued to be a major problem; that the major factor in July's poor performance was the lack of adequate process documentation which resulted in excess downtime; the first 1,500 bombs reduced from the press line were short on overall length resulting in additional downtime to clear the line of deviant product (SR4, tab 286).

116. On 13 and 16 July 1992 IMCO submitted for review and disposition the PITP and RITP respectively for the BDU-50 (R4, tabs 123, 124).

117. On 24 July 1992 the PCO acknowledged receipt of IMCO's 26 May 1992 certified claim. IMCO was informed the claim was under review and that an opinion on entitlement should be issued within 120 days. (R4, tab 5-125; finding 108 *supra*)

118. On 27 July 1992 IMCO submitted BDU-45/B PITP, revision 10, for review and disposition (R4, tab 5-126).

119. Mr. Steppe submitted, IMCO's GENERAL MANAGERS MONTHLY REPORT - AUGUST 1992, dated 15 September 1992, to Mr. Peppers wherein he stated that the gross margin shortfall was in pertinent part caused by prior months inefficiencies on the MK-82 line which resulted in both labor and overhead being charged to cost of sales at rates exceeding those incurred in August; that although total shipments for August were better than July, shipments were below the planned level of 8,640 units; that BDU-50 shipments on the initial contract were completed; and shipments of BDU-45 would begin in September. Mr. Steppe opined that the MK-82 production line had "soft spots," identified as "press and heat treat furnace availability, sandblast compressed air supply, and welding capacity constraints," for which he stated IMCO was "developing 'work around' plans" and he anticipated seeing continued improvement in September. (SR4, tab 287)

120. Oakite's representative, in a 28 August 1992 letter to IMCO, stated that after studying IMCO's phosphating process the following changes were necessary: one individual from each line should be made responsible for titration of the solutions and for coating weights tests; that since each individual on each shift has their own way of processing bombs that a step by step method of processing be published; a pump and proximity switch be installed to measure the zinc phosphate being added to avoid the characteristic yellowing caused by large additions of zinc phosphate; the cleaner be changed to a low heat cleaner which would be a more diversified cleaner, have a longer tank life and greater compatibility with the zinc phosphate solution, and have lower temperature capability; and reliable adjustable temperature controls be installed on the 500 pound line (SR4, tab 144).

121. In a 24 September 1992 internal memorandum IMCO personnel stated they were having an “intermittent” interference problem on BDU-45/B assembly in that the distance between the bottoms of the charge case was 0.150 less than the diameter of the largest fuze liner. It was suggested that the best solution was to move the charge case location forward about one inch. (AR4, tab A-24; SR4, tab 58)

122. Mr. Steppe submitted IMCO’s GENERAL MANAGERS MONTHLY REPORT - SEPTEMBER 1992, dated 16 October 1992, to Mr. Peppers wherein he stated that performance remained well below planned in most areas and revenue shortfalls of \$669,000 was caused by below planned shipment of MK-82 bomb bodies. Addressing the MK-82 production line Mr. Steppe opined production and shipment were limited by the availability of the sandblast and heat treat equipment; that the principal problem with the sandblast equipment was that the dust collection system was grossly undersized and as production volume increased the collectors are unable to remove sufficient quantities of fine from the media creating a build-up which ultimately required a complete shutdown and clean-up. Mr. Steppe further stated that the BDU-45 production and shipment were being limited by a defective Government temporary operating procedure (TOP) which resulted in an interference fit between the fuze liner and smoke canister in assembly; that the issue had been resolved in early October with a TOP change and IMCO will submit a claim to recover the costs incurred as a result of the TOP. (SR4, tab 288; finding 121 *supra*)

123. On 30 September 1992 the PCO informed IMCO that the five box cars loaded with BDU-45 and BDU-50 bomb bodies were acceptable to the Government and may be shipped without further rework or modification. However, IMCO, by requests for waiver (RFW), was to document the procedure employed in the rework and the waiver number was to be annotated on the ammunition data card furnished with each affected lot. The PCO also told IMCO the “white rag test” may be employed in the performance of contract C-1071 utilizing IMCO quality work instruction No. 80-001 and/or procedures acceptable to the on-site Government assurance representative. (AR4, tab A-25)

124. On 13 October 1992 the PCO, referencing the interference of BDU-45/B bomb charge cases with the aft fuze liner, provided IMCO with a 8 October 1992 NAWC memorandum (not made a part of the exhibit) with technical changes to alleviate the interference problem (AR4, tab 27).

125. On 29 October 1992 IMCO informed the PCO it concurred with NAWC’s 8 October 1992 proposal to eliminate interference being experienced in the BDU-45 A/B bomb bodies but requested:

The top of the .056 retaining ring groove shall be 0.050 + 0.070 -0.000 from the bomb surface at the location where the groove is closest to the bomb’s external surface, when measured along the dia. 2.625 bore,

be added. IMCO stated NAWC's proposal is a near term fix; that in its experience the assembly interference problem would be minimal using the 0.050 + 0.070 -0.000 call out; the issue is being reviewed by the Navy's Gage Laboratory ; and until IMCO receives PCO authorization to implement the dimensional change it will be unable to ship BDU-45 bomb bodies as the scrap rate at final assembly would be prohibitive. (AR4, tab A-28)

126. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY OPERATIONS REPORT - OCTOBER 1992, dated 17 November 1992, to Mr. Peppers wherein he stated the largest single improvement in October was in quality control achieved through improved control of operations and implementation of workmanship standards to replace subjective evaluation for nose surface conditions, rust, scale and chromate stain; efforts were continuing to develop weld quality standards to replace subjective evaluation in this area. However, Mr. Steppe stated BDU-45 production and shipment continued to be limited by a defective TOP which resulted in an interference fit between the fuze liner and the smoke canisters in assembly; that the issue was resolved in early November¹⁸ with a TOP change to relocate the smoke canister holes. (SR4, tab 289, finding 122 *supra*)

127. On 2 November 1992 the PCO issued a change to drawing 923AS118, sheet 4, adding note 11, and stating that a modification will follow. The change incorporated the proposal suggested by IMCO in its 29 October 1992 letter as the resolution for the dimensional error (R4, tab 4; AR4, tab A-29; finding 125 *supra*).

128. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - NOVEMBER 1992, dated 19 December 1992, to Mr. T. Stephen Melvin, wherein he stated BDU-45 production was below planned levels because the bomb bodies being used for this product are predominantly bombs being held for rework and the rework flow has been sporadic since the equipment used is also used for virgin production. Mr. Steppe further stated all the equipment purchased from H-D, except for two 600-ton presses, had been relocated to IMCO; that although the wheelabrator grit blast unit was installed and ready for operation in late November, integration of it into the operation was delayed to December due to a lack of bomb bodies resulting from the heat treat furnace outage. (SR4, tab 290)

129. Mr. Steppe submitted, IMCO'S GENERAL MANAGERS MONTHLY REPORT - DECEMBER 1992, dated 18 February 1993, to Datron's new director, Mr. T. Stephen Melvin, wherein he stated the rising reject rate for the BDU-50 due to cracks in the lug weld was a major problem since the cause was yet to be identified; BDU-45 units were set aside for rework and many of these units have been in storage for over a year and are heavily rusted; production was below forecast level due to very high reject rates at the detail area due to rust and corrosion; and IMCO's process is not capable of consistently removing the accumulated rust, particularly from the machined areas. Mr. Steppe's report further stated a revised phosphate process to add a pickling stage prior

to phosphating has been developed to remove rust and was submitted to AMCCOM for approval; and the wheelabrator entered full operation but downtime was high in December and is expected to remain high until sufficient quantities of spare parts can be identified and procured. (SR4, tab 352)

130. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - JANUARY 1993, dated 26 February 1993, to Mr. Melvin, wherein he stated an ECP was approved enlarging the lug holes thereby resolving the weld cracks problem with the BDU-50; that the BDU-45 production was below plan level due to reworked units being rejected due in large part to rust and weld workmanship (SR4, tab 291).

131. In her 14 January 1993 inter-office memorandum Ms. Doris Taylor, DCMDS Operations Analyst, provided her supervisor, Ms. Linda Campbell, with the following information (R4, tab 4 at 12 and 13 from end of tab):

First Article Test failed twice. This is not considered a Government delay. The first article presented by the contractor must follow guidelines for acceptance.

Production Delays - MK82 Bomb Body. First article failed twice, conditionally approved the third time. There were no shipments from April 91 thru [sic] October 91. The first shipment went out in November 91. Production delays in November and December were heat treat problems[;] paint/thread problems and charge tube problems. The paint/thread problem continued on into January 92 along with phosphate problems and illegible stencils. Final shipment of MK82 Bomb Body was in February 92.

BDU50 - First Article failed twice in May, conditionally approved in June, thread problems, and heat treat problems. These problems delayed shipments until February 92. In June 92, MCAAP called IMCO complaining that trailers had rotten beds; forklifts and drivers were falling through the trailers. Final shipment of BDU50 August 92.

BDU45 - Shipment delays on MK82 and BDU50 affected delivery of BDU45. First shipment made October 92. Production delay problem in October and November -charge case interferes with fuse liner, design defect. Drawing changed to correct deficiency

132. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - FEBRUARY 1993, dated 12 March 1993, to Mr. Melvin, wherein he stated MK-82's net gross margin loss was \$62K compared with the planned break-even primarily due to below planned shipments; that BDU-50 results were above plan level but due to equipment availability constraints it was necessary to sacrifice some BDU-45 production; wheelabrator availability was very poor due to very high wear rates on numerous components resulting in the unit being removed from service at month's end to make modifications to allow for rapid replacement of high failure rate components; and the sandblast cabinets planned for use on the BDU-45s were used to maintain product flow on the BDU-50 due to the poor wheelabrator availability. Mr. Steppe further stated the 500 pound bomb production was also limited by the necessity to remove one of the five CNC lathes from production for three weeks for overhaul. (R4, tab 4 (Report 19); SR4, tab 292)

133. Mr. Steppe submitted IMCO's GENERAL MANAGER'S MONTHLY REPORT - MAY 1993, dated 18 June 1993, to Mr. Melvin, wherein he stated overall May shipments were above plan but BDU-45 production was limited by smoke hole milling capacity due to an unreliable Hillyer vertical mill; that a H-D special purpose smoke hole machine was placed in service mid-month and after a slow start-up significantly improved BDU-45 production rates; product quality improved "slightly" in May with lack of material in the bomb nose, forming defects and cracks in the face and bore due to variability in the induction heaters and form die quality being the largest cause of failures. Mr. Steppe further stated rust, due to a combination of higher humidity and increased residence time in the plant, was the second leading cause for failures. He indicated that this problem would be resolved when the Government approved IMCO's converting from a five to eight stage phosphating system, one of the additional stages being an alkaline deruster. (SR4, tab 294)

134. On 21 May 1993 IMCO filed a supplement to its 26 May 1992 REA requesting a total contract adjustment of \$9,651,385 for alleged delays and disruptions caused by the Government's change in the heat treat procedures and the imposition of a defective specification which changed the phosphate requirements of the contract. IMCO further alleged that since the submission of the 26 May 1992 REA it experienced additional delay due to the Government's cleanliness inspection inconsistencies and Government-caused inspection requirement changes; the Government imposed defective specification which caused charge case fuse liner interference on the BDU-45 bomb bodies; and the Government refusal to accept reasonable deviations and waivers in a timely fashion on MK-82 bomb bodies in contravention of the established prior course of dealing. (R4, tab 6-1)

135. In Datron's APRIL FINANCIAL STATEMENT, dated 25 May 1993, Mr. Melvin stated the revised claim for the MK-82 now totaled \$9.65 million, an increase of approximately \$2.150 million, for additional delays and overhead disallowed for the MK-84 claim (SR4, tab 364).

136. Mr. Steppe submitted IMCO's GENERAL MANAGER'S MONTHLY REPORT - JUNE 1993, dated 21 July 1993, to Mr. Melvin, wherein he stated the major component of the MK-82's net gross margin loss in June was above plan labor consumption (approximately 1,500 man-hours) to remove rust from reworked bombs; but that the implementation of the 8-stage phosphate system in July was expected to eliminate this problem; that both BDU-50 and BDU-45 June shipments were below units planned; that due to IMCO's "failure to manage [its] subcontractors, the supply of smoke canisters for the BDU-45's was insufficient to meet plan." Mr. Steppe stated IMCO ran out of canisters on June 21 and was forced to alter its production plan and convert the BDU-45 line to produce BDU-50 bomb bodies. Mr. Steppe stated the emphasis was on reworking defective products produced earlier in the contract which, due to their having been placed in storage for over a year, have accumulated heavy rust that must be removed prior to finishing; that the rust in the machined areas required an additional 1,500 man-hours above that planned for the month of June; that IMCO anticipated that when the approved new phosphate process is fully implemented in July, the additional labor requirements for rust removal will be eliminated; that product quality control deteriorated significantly in June due to the increased flow of reworked product due to rust. (SR4, tab 295)

137. Mr. Steppe submitted IMCO's GENERAL MANAGER'S MONTHLY REPORT - JULY 1993, dated 21 August 1993, to Mr. Melvin, wherein he stated the July's production of MK-82 bomb bodies was "severely limited by downtime" on IMCO's Okuma mills; that 1 of the 2 mills was down for 2-1/2 weeks reducing production capacity by 50 percent; production was further limited by start-up difficulties on the 8-stage phosphate system. (SR4, tabs 278, 356)

138. IMCO on 2 September 1993, responding to a Government request, listed its chronology of significant events that form the basis of its claim as follows (AR4, tab O-1, exs. 13, 14):

Item #1

IMCO caused delays, (53 days) - Represents the period between the contractually scheduled FAT, 01/28/91 and the first actual FAT on 03/22/91. This delay is IMCO's responsibility as we were not fully prepared for FAT on 01/28/91.

Item #2

Heat treat & phosphate delay (234 days) - Represents to [sic] the time between 03/22/91, first actual FAT and 11/11/91, the date on which the first unit was delivered. IMCO believes these days to be Government responsibility. It was at the original FAT that IMCO was directed to cut coupons out of bomb bodies to verify physical characteristics. This new requirement

caused IMCO to begin a heat treat development program and delayed the start of production for a period of 234 days.

During the subsequent heat treat development program IMCO petitioned the contracting officer to authorize the use of “standard panels” to verify phosphate coating weights on bomb bodies. Though approved on all previous MK80 Series contracts, our standard panel request was denied. This event caused another development program to begin, further delaying production start up.

Even if IMCO’s inspection test plan documents did not satisfy technical requirements, any deficiency did not delay FAT approval. Because both the heat treat and phosphating process form a substantial portion of our inspection plan, it was impossible to obtain FAT approval before implementing the Government directed changes.

As IMCO was unable to begin production prior to successful FAT acceptance, we believe we are entitled to recover 100% of these days of delay.

Item #3

Cleanliness delay, adjusted (48 days) - Although the actual period in question ran from 04/12/92 to 10/01/92, (163 Days), IMCO’s production line was not completely interrupted. Product acceptance/deliveries dropped markedly and a large amount of rework was generated as we continued to chase the “Moving Target” of acceptance criteria.

We have prorated the number of delay days based on shipments before, during, and after the cleanliness issue.

Item #4

BDU45 drawing delay, (11 days) - This delay period began 08/01/92 during initial assembly attempts and ended upon receipt of DWG change 11/01/92, (92 days). As IMCO was able to begin production on the . . . 0572 contract, complete line shut down was avoided.

IMCO has prorated the delay based on co-production shipments & actual BDU45 shipments after drawing change was received.

Item #5

Hardness - increased machining cycle times, (51 days) - This period considers total contract performance and the additional days required to deliver the contract complete due to harder bomb bodies and their impact on machining efficiencies. This period has been calculated at 51 days, of additional contract performance.

The total government caused delay as exhibited equals 344 days. IMCO's claim requests compensation for only 298 days of the delay. We believe our request to be fair and reasonable.

139. On 8 October 1993 the PCO informed IMCO that after reviewing the facts and circumstances delineated in the REA it was determined there was a basis for partial entitlement and the proposal has been sent to the Defense Contract Audit Agency (DCAA) for audit. During the auditing period the PCO requested that IMCO provide information/documentation demonstrating the Government's approval of the implementation of the "white rag test," and clarification for why the delay period goes beyond 23 July 1991, the date IMCO was authorized to begin production, to 11 November 1991, the date the first unit was delivered. (R4, tab 5-133; AR4, tab A-30)

140. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - NOVEMBER 1993, dated 31 December 1993, to Mr. Melvin, wherein he stated the net gross margin on the FY90 (C-1071) and FY91 MK-82 contracts, both of which are scheduled for December completion, was a break-even with losses of \$331,000 offset by reserve consumption and that the remaining reserve on these contracts will be sufficient to cover remaining contract losses. Mr. Steppe further stated that most of the bombs produced were very rusty, due to their having been produced early-on during contract performance requiring multiple passes through both sand blast and phosphate to remove all of the rust; that rust was the leading cause of rejects due to two periods when concentrations on the eight stage phosphate unit were approaching the operating range extremes; that the operating range had been reduced to prevent recurrence; and that defective lug welds contributed to the rejects which reflects the performance of newly hired welders to increase staffing to a full two shifts basis. (SR4, tab 360)

141. Mr. Steppe submitted IMCO's GENERAL MANAGERS MONTHLY REPORT - DECEMBER 1993, dated 25 January 1994, to Mr. Melvin wherein he stated the FY90 contract C-1071 for MK-82 bomb bodies had been completed (SR4, tab 361).

142. In a 4 April 1994 letter to Commander, AMSMC, the Navy's Director, Weapons Directorate, discussing IMCO's claim under contract C-1071 stated IMCO did not produce 500 pound bombs for "about 10 years" prior to contract C-1071; that MIL-H-6875, revision G, a requirement under IMCO's contract, required hardness testing

of heat treated parts; that correlation of hardness to the tensile strength of the heat treated part was required; that instead of hardness testing for the FAT, IMCO submitted test data from specimens cut from the same material; that the drawings and specifications did not specify specimen tension testing; that MIL-H-6875 revision G, amendment 2 allowed specimen testing only when specified; that the drawings did require that the actual heat treated bomb meet physical properties of 105,000 psi tensile strength, 70,000 psi yield strength and 16 percent elongation; that revision F paragraph 6.3 of the specifications, which was a requirement of previous IMCO bomb contracts, required that specimens of the same material as the part be heat treated and tension tested; and the heat treat requirements of IMCO's prior contracts and contract C-1071 were different. The Navy further stated its representative, Mr. John Piercy, observed MK-82 bombs exiting from the furnace that were not uniformly red, indicating furnace problems leading him to conclude the test specimens would not have the same physical properties as the FAT sample; that IMCO experienced problems during the three FATs which would have resulted in delays attributable to IMCO alone; that the aft ring adaptor was made of 1035 steel that, when heat treated, would be harder than the bomb body which was made from 1025 steel; that IMCO's cost for using boron nitride to reduce the hardness of the aft ring adaptor should not be borne by the Government; IMCO had phosphate and cleanliness problems during contract performance, *i.e.*, phosphate residue on the bombs, imbedded scale, grit in grit blaster, rust from storing bombs outside; and delay experienced after February 1992 could not be attributable to this contract since all deliveries were completed by then. (SR4, tab 215)

143. On 8 November 1994 the PCO informed IMCO its 26 May 1992 REA, amended 21 May 1993, had been reviewed and was found to neither state a viable legal theory for recovery nor provide an adequate or reasonable computation for the claimed contract price adjustment of \$9,651,385. The PCO letter opined that IMCO contended the costs incurred were due to the Government waiving important 500 pound bomb body requirements based upon a prior course of dealings or conduct and the Government knew it was accepting non-conforming products due to IMCO's inspection/acceptance procedure of using coupons. Accordingly, the PCO determined that IMCO was not entitled to a contract price adjustment but for the sake of avoiding litigation costs and for the "sole purpose of settling this matter," and not as an admission against interest or a waiver of any Government rights, IMCO was offered an amount as full, complete, and final settlement of the subject matter. (AR4, tab A-31) IMCO did not accept the offer (R4, tab 5-141).

144. On 16 February 1995 the PCO issued a final decision stating in pertinent part (AR4, tab A-32):

[I]t is initially determined that IMCO's reliance upon the "prior course of dealing" concept is only partially apposite since the Government did not, at any time, change or acquiesce in a change to the contract requirements for the item being procured. To the extent that there may have been relevant

“prior course of dealing” between the parties, such development involved exclusively the inspection/test method of using “hanging coupons” which did not entail a knowing waiver by the Government of the contractually specified metallurgical/mechanical properties of the bomb bodies.

According, the Government is not liable for any of the alleged cost increases incurred by IMCO attributable to process changes which may have been implemented in order to ultimately produce conforming end items. In contrast, the Government may have responsibility for additional performance cost directly associated with apparent changes in acceptable inspection/test methods; in that respect, the undersigned determines that IMCO is entitled to an adjustment in the amount of \$7,154 representing additional performance cost ascribable to destructive testing of 94 units.

Concerning the phosphate coating issue, it is determined that the Government’s action in requesting confirmatory [sic] data or test results showing the reliability of using “standard panels” prior to permitting the use of “standard panels” was proper and reasonable. Further, IMCO did not quantify the monetary impact of this Government action. Thus, IMCO has not demonstrated entitlement.

Concerning the “cleanliness” issue, it is determined that IMCO has not proven that its experience reject rate was caused by either the Government’s refusal to use the “white cloth” test or by later applying the test incorrectly. Thus, IMCO is not entitled to recover the requested amount of \$176,306.

Concerning the tolerance stack-up issue, it is determined that the technical data package was defective in this regard; however, IMCO did not quantify the impact of this Government change and any resulting cost in its REA. Based upon lack of evidence establishing quantum and the lack of a specific amount in the REA, IMCO cannot recover on this issue.

Concerning the waiver/deviations issue, it is determined that IMCO does not have a right to waivers and deviations and that the Government has the right to obtain products in strict conformance with the contract’s TDP. Thus, IMCO has not

established entitlement to recover any costs associated with this issue. Additionally, IMCO's REA did not quantify or specifically identify the cost associated with this issue. Accordingly, IMCO is not entitled to recover on this issue.

In summary, IMCO's REA, in the amount of \$9,651,385, lacked adequate or solid evidence for the requested amount and the legal theories for recovery are not applicable under the facts and circumstances. Since IMCO's legal theory of "prior course of dealing" may apply in an extremely limited sense, the undersigned determines that IMCO is entitled to recover \$7,154 for the 94 units destroyed during testing. Therefore, except for the \$7,154, IMCO's REA is denied.

145. On 14 March 1995 IMCO appealed the CO's final decision (R4, tab 5-146). On appeal, IMCO increased the amount of its claim to \$11,942,257 to reflect additional cost data (app. br. at 1).

146. In a 21 August 1996 memorandum IMCO personnel discussing the maintenance records for the MK-82 furnace stated there were no records for periods prior to 1993; that in reviewing the old work orders it was found that the identical problems occurred in the 1989, 1993, 1994, 1995 furnace operations, that at the end of the MK-82 contract in June 1995 a full time maintenance technician was stationed at the furnace while heat treating was in operation as the only means available to keep the furnace operational; that the furnace has not been rebuilt nor the controls changed and work order trends indicate the furnace has deteriorated further each time IMCO produced MK-82 bombs (SR4, tab 69).

147. In a 26 November 1996 internal memorandum IMCO employees discussing the heat treat procedures stated that prior to 1991, 1025 steel was used to manufacture all MK-80 series bomb casings; that because the method of acceptance of the heat treat was changed, IMCO went into an R&D program with the heat treat procedures/process to arrive at a process that would comply with the changed method of acceptance; the physical properties of the 1025 pipe at hand, however, were so borderline after heat treat as to be incapable of yielding a consistent product all the time resulting in several heat treat lot failures and reruns; that when the 1028 pipe change over occurred, consistent heat treat results, using the same heat treat procedures, were achieved; and the heat treat process was effective prior to FAT acceptance (SR4, tab 212).

PRELIMINARY MATTERS

IMCO, on 6 February 1998, filed a “MOTION FOR PARTIAL SUMMARY JUDGMENT (HEAT TREATMENT)” wherein it requested the Board “to determine whether the Government constructively changed the Contract by applying the physical properties requirement of the Contract to the bomb casings themselves, and not to the incoming material.” The Board deferred ruling on the motion until after the hearing (tr. 1/66-67, 11/8). The Board has reviewed the motion and find that the issue raised was IMCO’s underlying allegation for its EA claim and was a subject of the hearing.

We find that IMCO’s MOTION FOR PARTIAL SUMMARY JUDGMENT (HEAT TREATMENT) has been subsumed in its case-in-chief presented at the hearing. The motion is moot and, accordingly is denied.

DECISION

Appellant has the burden of proving its affirmative claim against the Government by a preponderance of the evidence and in a case heard on entitlement only appellant is required to establish liability and at least the fact of resultant injury. *Wilner v. United States*, 24 F.3d 1397, 1401 (Fed. Cir. 1994) (*en banc*); *John T. Jones Construction Co.* ASBCA Nos. 48303, 48953, 98-2 BCA ¶ 29,892 at 147,974, *affd. sub nom. John T. Jones Construction Co. v. Caldera*, 178 F.3d 1307 (Fed. Cir. 1998) (table); *Planning and Human Systems, Inc.*, ASBCA No. 29725, 90-2 BCA ¶ 22,821 at 114,596 and cases cited.

HEAT TREATMENT CLAIM

PHYSICAL PROPERTY ISSUE

It is uncontested that Drawing Nos. 1380548M and 923AS183B, Casing, Bomb Body each incorporated the following note (finding 4 *supra*):

1. MATERIAL: STEEL WHICH WILL PRODUCE THE FOLLOWING MINIMUM PHYSICAL PROPERTIES AFTER HEAT TREATMENT. HEAT TREAT AFTER WELDING.

YIELD STRENGTH - 70,000 POUNDS PER SQUARE INCH

TENSILE STRENGTH - 105,000 POUNDS PER SQUARE INCH

ELONGATION IN 2 INCHES - 16 PERCENT

and Drawing 1252606H, Ring, Adapter, Bomb Body incorporated the following note (finding 7 *supra*):

1. MATERIAL: STEEL HAVING THE FOLLOWING
MINIMUM PHYSICAL PROPERTIES AFTER HEAT
TREATMENT.
YIELD STRENGTH - 70,000 POUNDS PER SQUARE
INCH
TENSILE STRENGTH - 105,000 POUNDS PER SQUARE
INCH
ELONGATION IN 2 INCHES - 16 PERCENT

IMCO contends the physical properties, *i.e.*, yield strength, tensile strength, and elongation, were applicable to the material from which the bomb bodies were to be made. The Government contends the physical properties were applicable to the subsequent bomb bodies themselves (findings 4, 108, 144). The law is clear that a reasonable interpretation requires that all parts of the contract must be read together and harmonized if at all possible. *HSQ Technology*, ASBCA No. 38794, 90-1 BCA ¶ 22,477, *citing Hol-Gar Mfg. Corp. v. United States*, 351 F.2d 972 (Ct. Cl. 1965).

The proper and only reasonable interpretation of the notes on drawings 1380548M, 923AS183B and 1252606H is that the minimum mechanical property requirements were to be achieved after heat treatment which was to take place after welding was completed; and that general requirements were to be in accordance with Drawing 2518492 which took precedence over any requirement referenced or specified (findings 4, 5, 7 *supra*). The notes on Drawing 2518492M addressing “HEAT TREATMENT,” state all *bomb bodies* shall be heat treated in order to meet the prescribed mechanical properties; all welding and forming shall be completed on the bomb body prior to heat treatment; the whole bomb body may be heat treated by normalizing, normalizing and tempering, or liquid quenching and tempering in order to meet the prescribed mechanical requirements, and heating for straightening subsequent to heat treatment may be permitted provided that the heating does not involve temperatures which result, locally or generally, in lowering the prescribed mechanical properties of the material or undue distortion of the structures (emphasis added) (finding 8 *supra*). There is no question but that the MK-82 bomb bodies were the end product of contract C-1071. Accepting IMCO’s interpretation that the material from which the bomb bodies were manufactured had to meet the mechanical properties set out in the drawing notes, and not the bomb body after production, would negate and make superfluous the above stated contract requirements for the end product, the bomb body, to meet the mechanical properties (findings 4, 7 *supra*). We find such a determination to be illogical and unreasonable.

Ambiguity exists where an interpretation of the contract is “susceptible of two different interpretations, each of which is consistent with the contract language” and

both interpretations fall within a “zone of reasonableness.” *Metric Constructors v. NASA*, 169 F.3d 747, 751 (Fed. Cir. 1999), citing *Hills Materials Co. v Rice*, 982 F.2d 514, 516 (Fed. Cir. 1992); *Newsom v. United States*, 676 F.2d 647, 649-50 (Ct. Cl. 1982); *HSQ Technology, supra*. Assuming, *arguendo*, we determined that both IMCO’s and the Government’s interpretations were consistent with the contract language we would then have to determine whether the ambiguity is latent or patent. An ambiguity is patent if it is “so glaring as to raise a duty to inquire[.]” *Newsom v. United States, supra*. Mr. Terranova testified that he found, during the preparation of IMCO’s bid, the information on drawings 1380548, addressing the physical properties, and 2518492, addressing heat treatment, to be confusing and contradictory (findings 4, 8, 21). Therefore, Mr. Terranova was faced with a known ambiguity and, accordingly, he had a duty to inquire before submitting appellant’s bid. *Id.* at 649. Mr. Terranova’s failure to inquire bars IMCO from recovering for compliance with the direction of the Government that the bomb bodies, and not the material from which the bomb bodies are manufactured, must meet the yield and tensile strengths and elongation requirements.

CONSTRUCTIVE CONTRACT CHANGE (USE OF BOMB BODY COUPONS)

IMCO argues that the Government constructively changed the requirements of the contract when, during the first FAT, IMCO was told that a correlation had to be established between standard material coupon specimens (sometimes referred to as hanging coupons), taken from the pipe that bomb bodies were being manufactured from, and actual bomb body coupon specimens to show that a consistent yield and tensile strength and elongation requirement was being achieved throughout the bomb bodies after heat treatment. In furtherance of this argument IMCO states it based its bid on the belief the material coupons specimens would be approved for use to establish that bomb bodies met the mechanical requirements called out in the contract since their use was established during prior contracts; that due to the differences in thickness of sections of a bomb body a consistent yield and tensile strength and elongation throughout was not possible to attain; that the Government’s requirement to take specimens from bomb bodies was a destructive test; that destructive testing was not a contract requirement; that IMCO’s development effort to establish a correlation between the material specimen and bomb body specimen resulted in additional cost being incurred and delayed FA acceptance. (Finding 108, 138)

We are persuaded that the use of material coupon specimens to establish the physical properties of the bomb bodies was a permitted procedure on prior MK-80 contracts; that IMCO used/was using this procedure on prior MK-83 and MK-84 contracts awarded after the single management agreement was executed; that the record does not show that during the execution of prior MK-80 contracts IMCO was required to establish a correlation between the material coupons specimens and the bomb body specimens, and that the Government initially approved continuation of the practice on this contract (findings 19, 23, 25, 30, 33, 37). To show a constructive change, appellant must prove that: “(1) a change occurred, (2) the change was not voluntarily done but as a result of

Government direction and (3) a reliance on the direction thus increasing costs.” *Combination Industries, Inc.*, ASBCA No. 47789, 95-1 BCA ¶ 27,418 at 136,659, quoting *Dan G. Trawick III*, ASBCA No. 36260, 90-3 BCA ¶ 23,222 at 116,541. At the first FAT, under contract C-1071, IMCO was required to establish a correlation between material coupon specimens and bomb body specimens although the contract did not call for it; IMCO did perform tests to establish the correlation (findings 45, 46, 47, 49, 54, 56, 74, 108). Under the contract’s Changes clause, appellant is entitled to an equitable adjustment consisting of the difference between the reasonable cost of performing the work with and without this change. *Environmental Safety Consultants, Inc.*, ASBCA Nos. 47498, 00-1 BCA ¶ 30,826 at 152,143, citing *B.R. Services, Inc.*, ASBCA Nos. 47673 *et al.*, 99-2 BCA ¶ 30,397 at 150,271-72. It is determined that IMCO would be entitled to the incurred additional cost for having to establish the correlation as required by the Government.

Addressing IMCO’s contention regarding the requirement to remove coupon specimens from bomb bodies it is uncontested that such a procedure resulted in the bomb bodies’ destruction. Leaving aside the fact that IMCO had not produced the MK-82 bomb body in the 8-years prior to contract C-1071; had never manufactured the BDU-45 and BDU-50; and during prior contract performances IMCO’s quality was problematic, all of which would lead the Government to want assurances of IMCO’s ability to perform (findings 16-17, 19), the FA clause of the contract informed prospective bidders that the FA items shall be inspected and tested to all requirements, and all FA pieces were, without contractual exemption, subject to destructive testing, the cost of which was included in the contract unit price (finding 2 at E-4 and E-9). Suffice it to say we find ourselves hard pressed to conclude IMCO was unaware of destructive testing for its FA units.

PHOSPHATE COATING REQUIREMENT CLAIM

IMCO contends that contract C-1071 required that the phosphate coating be applied in accordance with original Specification TT-C-490C; that Amendment 1 to TT-C-490C had been issued prior to the award of contract C-1071; that the phosphate requirement called out in Amendment 1 for a weight variation of 300 ± 50 mg/sq. ft was not measurable because measuring equipment to verify the application did not exist; that in prior contracts IMCO applied the phosphate coating in accordance with the original TT-C-490C which only specified a 300 mg/sq. ft minimum, no maximum, coating weight; that in prior contracts the Government allowed IMCO to use standard test panels to verify the phosphate coating weight; that IMCO, based on this prior course of dealing, bid the contract based on using standard test panels and the original TT-C-490C. IMCO complains that after contract award it was told to comply with the phosphate coating variances cited at TT-C-490C Amendment 2; Amendment 2 of TT-C-490C had been issued 29 June 1990, prior to award of contract C-1071; Amendment 2 of TT-C-490C allowed for a 300-500 mg/sq. ft vice the 300 ± 50 mg/sq ft zinc phosphate coating variance of Amendment 1; that IMCO was unable to consistently achieve the 300-500 mg/sq. ft zinc phosphate coating required by Amendment 2; that the Government denied IMCO’s request to use standard test panels to determine the

weight of the zinc phosphate coating applied to the bomb bodies; that IMCO was required to use material cut from the actual pipe used in manufacturing the bomb body to verify the phosphate coating process; and that the rough surface of the bomb body material was not conducive to getting the accurate weight of the applied phosphate. IMCO further contends that its contract performance was delayed and it incurred additional costs because of the Government's constructive change to the contract requirements regarding the application of the zinc phosphate coating. (Findings 1 at § A-2, 9, 39, 42, 44, 69, 108, 134, 138, 144)

TT-C-490C was the federal specification applicable under contract C-1071 for the cleaning and phosphate coating of the MK-82 bomb bodies. At the time the solicitation was issued and contract C-1071 awarded both Amendments 1 and 2 to TT-C-490C had been issued (finding 9 at ¶ 1.2.2). Both parties agree that ADLs 1380545A, 923AS116A and 923AS651 all state Amendment 1 to the TT-C-490C was applicable to the manufacture of the MK-82, BDU-45 and BDU-50 bomb bodies (findings 11-13). Mr. Terranova testified he prepared and submitted IMCO's bid based on his determination that no amendments had been issued to TT-C-490C (finding 21). It is black letter law that a contractor is obligated to review contract specifications and drawings and failing to do so will be deemed a non-compensable mistake in judgment. *Liebherr Crane Corp. v. United States*, 810 F.2d 1153 (Fed. Cir. 1987); *Apache Construction Company, Inc.*, ASBCA No. 36895, 90-2 BCA ¶ 22,718. We conclude that Amendment 1 was applicable to the contract.

IMCO also argues that it was entitled to recover for its attempt to meet an impossible specification requirement, *i.e.*, the narrow zinc phosphate requirements called out in Amendment 1. IMCO, to prevail in its argument that the specifications were defective, must prove (1) that it reasonably relied upon such defective specification to its detriment; (2) that a satisfactory product meeting the contract performance requirements could not have been reasonably supplied following such defective specifications; and (3) that it was damaged as a direct result of its efforts to provide a product that met the contract requirements. *Electrical Contracting Corporation of Guam, Inc.*, ASBCA No. 33136, 90-3 BCA ¶ 22,974 at 115,381 and cases cited. As testified to by Mr. Terranova, IMCO, at the time it prepared and submitted its bid, did not rely on using Amendment 1 of TT-C-490C to comply with the zinc phosphate application requirement (finding 21). Accordingly IMCO cannot now argue that it was somehow damaged by its inability to perform to Amendment 1 since its bid was submitted without considering Amendment 1 as a requirement of the contract. IMCO's failure to establish bid reliance on Amendment 1 of TT-C-490C forecloses its ability to prove it was damaged as a direct result of its efforts to provide a product that met the contract requirements. *Id.*; *Western States Management Services, Inc.*, ASBCA No. 41880, 93-1 BCA ¶ 25,469.

However, this does not end the discussion for Amendment 1 of TT-C-490C was applicable to contract C-1071 and IMCO was to have applied the zinc phosphate in accordance with either Class 2A, 300 ± 50 mg/sq ft (an impossible requirement), or Class 2B, 600 to 1000 mg/sq ft (a possible requirement) (finding 9). IMCO, unaware of these

alternative requirements, assumed that it was to apply phosphate coating in accordance with TT-C-490C, no amendment. When IMCO became aware of Amendment 1 is not established in the record. However, the record does establish that at the 6 November 1990 post award quality assurance conference, IMCO was offered a no cost modification allowing it to use the zinc phosphate coating application called out in Amendment 2 of TT-C-490C, 300 - 500 mg/sq ft (finding 29). It was never established in the record that IMCO accepted the Government's offer (*cf.* findings 34, 69). However, it would appear that IMCO did attempt to meet the requirements of TT-C-490C, Amendment 2 for there is correspondence in the record wherein Oakite, IMCO's phosphate chemical supplier, advised IMCO on changes to make to meet the 300 - 500 mg/sq ft requirements of Amendment 2 (finding 43). No effort to comply with TT-C-490C Amendment 1 was proven.

As we have discussed *supra*, to prove a constructive change, appellant must prove that: "(1) a change occurred, (2) the change was not voluntarily done but as a result of Government direction and (3) a reliance on the direction thus increasing costs." *Combination Industries, Inc., supra*. Although IMCO was not aware of the requirements of Amendment 1 when it submitted its bid, the Government did not require IMCO to perform to Amendment 1, offering instead that IMCO perform to Amendment 2. Having elected to change the requirements of the contract regarding the zinc phosphate the Government constructively changed the contract requirements; IMCO performed to the Government's direction; and IMCO, to the extent it incurred additional cost for complying with the Government's direction, is entitled to the difference between the cost for performing pursuant to Amendment 1 (the 2B alternative) and the cost for performing pursuant to Amendment 2. *Environmental Safety Consultants, Inc., supra*.

PRIOR COURSE OF DEALING (PHOSPHATE COATING)

Addressing IMCO's contention it prepared its bid relying on a prior course of dealing, *i.e.*, the use of standard test panels to verify the phosphate coating weight, it is noted that there were problems with a lack of adherence of the phosphate coating in prior contracts and IMCO agreed to make major improvements to its production line (findings 17, 27, 34). Oakite, IMCO's zinc phosphate supplier, upon reviewing coating procedures recommended that IMCO, to meet the tight parameters for the zinc phosphate application, install thermostatic controls on all heated tanks; that a continuous feed pump be installed on each zinc phosphate tank; that a low heat cleaner be tested as a possible replacement for the #190; and that the procedure for processing bomb bodies through the five stages be published and implemented (finding 81). Suffice it to say that IMCO was aware of the prior problems associated with its zinc phosphate application and knowingly contemplated making changes to the process. No abuse of discretion by the PCO has been shown.

FIRST ARTICLE TEST

IMCO contends that the Government's failure to approve the FAT without requiring the bomb body to be destructively tested delayed its performance (finding 108). IMCO's contention is predicated on its original argument that the physical requirements of the contract were not to be applied to the bomb bodies but rather to the material from which the bomb bodies were manufactured. We have addressed this contention and found it to be unreasonable. In like fashion IMCO's assertion that destructive testing delayed its contract is also unreasonable.

Assuming, *arguendo*, we accepted IMCO's contention regarding the physical requirements of the contract, which we do not, the claim of delay would still fail. To prevail on its claim of compensable delay IMCO must establish the extent of the delay, the contractor's harm resulting from the delay, and the causal link between the Government's wrongful acts and the delay. *Essex Electro Engineers, Inc. v. Danzig*, 224 F.3d 1283, 1295 (Fed. Cir. 2000); *St. Thomas Enterprises*, ASBCA No. 38069, 92-3 BCA ¶ 25,142 at 125,320. The Court in *Essex v. Danzig*, *supra*, citing *Coath & Goss, Inc. v. United States*, 101 Ct. Cl. 702, 714-15 (1951), held "[t]he contractor generally cannot recover for concurrent delays for the simple reason that no causal link can be shown: A government act that delays part of the contract performance does not delay 'the general progress of the work' when the 'prosecution of the work as a whole' would have been delayed regardless of the government's act." IMCO does not dispute that at the time of its first FAT, conducted 20-22 March 1991, its SPC plan was not implemented; it took no action to verify that its charts indicated an in-control operation; inspections were performed with unauthorized equipment; gauges were not identified by revision number; and the required gauges were not available (findings 45-48, 50). IMCO's first FAT failure is determined to have been due in significant part to concurrent causes attributable to IMCO.

IMCO's second FAT, conducted 30 April through 3 May 1991, failed in part due to gauges not being available; IMCO's ITP being inconsistent with designs called out in the drawings and specifications; calibration program not in compliance with MIL-STD-45662; and calibration records being calibrated on non-existing gauges (findings 51-53, 57-59). IMCO neither disputed the validity of the Government's findings made during the second FAT, nor that it, IMCO, was not ready for the test, that IMCO had a statistical process control problem as well as problems with controlling gauges; and that IMCO needed to take considerable corrective action to rectify all known non-conformance areas (findings 52, 61). As with the first FAT it is apparent that the failure of IMCO's second FAT was due in significant part to concurrent causes attributable to IMCO.

IMCO's third FAT, conducted 16-19 July 1991, was conditionally approved. Based on the discussion above IMCO has failed to prove the unsuccessful first and second FAT were due solely to Government responsible causes. Accordingly, we find that IMCO's

claim for delay due to the Government's refusal to accept the first and second FAT is denied for lack of proof.

DELAY IN CONTRACT PERFORMANCE

IMCO alleges it was delayed in completing the contract due to the constructive changes in the heat treatment and phosphate coating requirements. At the outset we address a number of significant problems we are faced with in deciding this portion of IMCO's appeal. The most significant problem and one which has caused us the greatest concern is that IMCO, while producing the MK-82 bomb bodies under contract C-1071, was producing the MK-82 under two additional contracts while performing contract C-1071 (finding 19; note 7 *supra*). What makes this problem significant is that IMCO claims it was delayed during the performance of contract C-1071 while concurrently producing bomb bodies for the three MK-82 contracts and the MK-83 contract on the MK-83 production line. Neither party addressed the issue of the simultaneous performance of multiple contracts and IMCO, allegedly experiencing problems with the manufacturing process of the MK-82, infers that all of the problems associated with the MK-82 were experienced during the performance of contract C-1071. Although IMCO alleges a harder MK-82 bomb body caused its machinery to malfunction we find that, while performing the three MK-82 and the MK-83 contracts, IMCO experienced production problems which were solely of its own making (findings 57, 64, 67, 68, 78, 81-82, 91, 93-94, 96, 99, 104, 109-10, 115, 119-20, 122, 126, 128-30, 132-33, 136-37, 140, 146-47). IMCO has failed to prove either that only bomb bodies from contract C-1071 were the direct cause of its delay or that the delay was solely the cause of the Government. *Essex Electro Engineers, Inc. v. Danzig, supra*.

BDU-45 CHARGE CASE INTERFERENCE

IMCO claimed that it incurred additional cost and delay when it encountered an interference in the distance between the bottoms of the charge case and the fuze liner in the BDU-45 bomb bodies (findings 121, 134). The record clearly indicates that on 24 September 1992 IMCO personnel suggested a correction for this problem (finding 121); that an 8 October NAWC memorandum with a technical change to alleviate the interference was provided to IMCO by the PCO on 13 October 1992 (finding 124); IMCO on 29 October 1992 informed the PCO that it concurred with NAWC's proposal (finding 125); and on 2 November 1992 the PCO issued a change incorporating the proposal suggested by IMCO in its 29 October 1992 letter (finding 127). We see no reason to belabor this issue for IMCO has proven the Government changed the contract requirements regarding the tolerances associated with the fuze liner and the bottom of the charge case. As previously stated IMCO is entitled an equitable adjustment consisting of the difference between the reasonable cost of performing the work with and without a change. *Environmental Safety Consultants, Inc., supra*.

CONCLUSION

The appeal is granted in part as stated *supra* and IMCO is entitled to an equitable adjustment, subject to proof of the additional costs incurred, for the Government changes to the contract relating to the heat treatment, phosphate coating, and interference in the BDU-45 charge case. In all other respects the appeal is denied.

Dated: 3 January 2003

ALLAN F. ELMORE
Administrative Judge
Armed Services Board
of Contract Appeals

(Signatures continued)

I concur

I concur

MARK N. STEMLER
Administrative Judge
Acting Chairman
Armed Services Board
of Contract Appeals

EUNICE W. THOMAS
Administrative Judge
Vice Chairman
Armed Services Board
of Contract Appeals

NOTES

¹ IMCO originally claimed an equitable adjustment of \$7,574,993 which was subsequently amended upward to \$9,651,385 and later to \$11,942,257 (Bd. corr. file, First Amended Compl.).

² The record includes the Government's appeal (R4) and supplemental (SR4) files and exhibits to appeal file tabs; appellant's appeal (AR4) file; stipulations (stip.); Government (G-) and appellant (A-) hearing exhibits (ex.); Government's brief

(Gov't br.) and reply brief (Gov't reply br.); appellant's brief (app. br.) and reply brief (app. reply br.); transcripts (tr.); proposed findings of fact (PFF); and the Board's correspondence file (Bd. corr. file).

3 FAR 52.215-33 Order of Precedence states "Any inconsistency in this solicitation or contract shall be resolved by giving precedence in the following order: (a) the Schedule (excluding the specifications); (b) representations and other instructions; (c) contract clauses; (d) other documents, exhibits, and attachments; and (e) the specifications."

4 Revisions K and L of drawing 2518492 each included the same notes (AR4, tabs K-9 and K-10).

5 We have listed the pertinent paragraphs from the original federal specification TT-C-490C and Amendments 1 and 2. Changes made by Amendments 1 and 2 are preceded with the applicable amendment in brackets. If no amendment is cited then the paragraph is from the original specification. (R4, tab 2-2)

6 ADL 923AS651, Change Notice 002 dated 29 April 1991 replaced item 5B as cited (R4, tab 2-4, Bates page GGR1001950).

7 IMCO was producing bomb bodies under contracts DAAA09-91-C-0572 and a 1993 contract, both follow-on contracts to contract C-1071; DAAA09-91-C-0576; and DAAA09-91-C-0573 (MK-84) (R4, tab 4; tr. 1/94-95).

8 There is also undisputed evidence that IMCO purchased 1028 steel for use in contract C-1071 and this steel achieved consistent results at the heat treat process (SR4, tab 212).

9 Ms. Story testified she was not a certified metallurgist and could not perform testing to determine why IMCO was experiencing problems machining the bomb bodies (tr. 2/93-94).

10 Hearing exhibits A-1, -2, -3, an actual bomb body and aft adapter ring, were replaced with photographs, marked as exs. A-23, -24.

11 For the BDU-45 two additional holes, called smoke holes, are cut near the end of the bomb body for the charge cases (tr. 4/189-90).

12 The form was signed but undated by Mr. Thomas. We conclude that since he
authorized the typewritten portion of the document, that he signed it on
12 December 1990, the purported date the document was prepared (AR4, tab B-13).

13 The Board has no record that this unsigned document was objected to (AR4, tab
B-27A).

14 On a number of documents there are references to IMCO's contracts for the MK-83
and MK-84, the 1000 and 2000 pound bomb body respectively. We cite these other
contracts for continuity (see note 7 *supra*).

15 Ms. Hepner was subsequently married and identified herself as Ms. Lisa Haptonstall
when she testified (tr. 9/6). In this decision for identification purposes and
continuity we will use the name Ms. Hepner vice Ms. Haptonstall.

16 An identical internal memorandum dated 22 October 1991 is located at SR4, tab
152. We are unable to reconcile the discrepancy with the dates of the two
memoranda and, accordingly, will use 30 September 1991 as the original date for the
memorandum since it concurs with the Government's prior correspondence and the
findings stated therein (findings 76, 78, 82 *supra*).

17 IMCO on 21 May 1993 filed a "Supplemental Request for Equitable Adjustment"
increasing the request for a contract adjustment to \$9,651,385 for impact costs
incurred as a result of the issues identified in its original REA (R4, tab 6-1; finding
134 *supra*).

18 We view the month of November as a typo since the record clearly indicated IMCO
concurred in the Government's suggested fix for the interference in October
(finding 125 *supra*).

I certify that the foregoing is a true copy of the Opinion and Decision of the Armed
Services Board of Contract Appeals in ASBCA No. 48506, Appeal of Intercontinental
Manufacturing Co., rendered in conformance with the Board's Charter.

Dated:

EDWARD S. ADAMKEWICZ
Recorder, Armed Services
Board of Contract Appeals