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[redacted] 25X1

14 April 1964

Please Reference:
4W-1362

U. S. Government
Washington, D. C.

Attention: [redacted] 25X1

Subject: HTA/6

[redacted] is pleased to submit an unsolicited proposal for a model HTA/6 photographic film processor. This processor utilizes the latest concepts in the processor state-of-the-art and we are confident that it will meet with your requirements. 25X1

We would be pleased to undertake this program on a CPFF basis with a total [redacted] The program can be completed within twelve (12) months after receipt of the contract. 25X1

Enclosed herewith for your evaluation is the technical dissertation on the proposed processor. If there are any questions or any additional information you require please feel free to contact either [redacted] 25X1 25X1

Very truly yours,

[redacted] 25X1

Director of Contracts

RJN:gw
enclosures

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4W-1362B

TECHNICAL PROPOSAL

MODEL HTA-6 PHOTOGRAPHIC FILM PROCESSOR

25X1

April 1964

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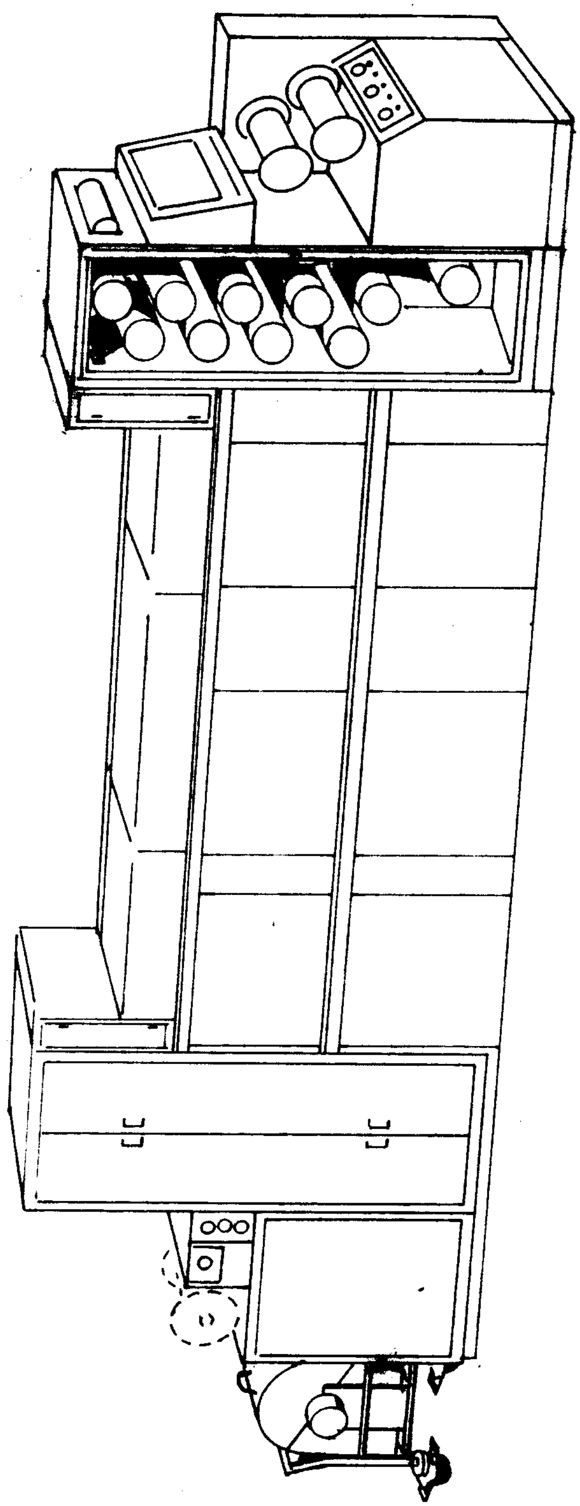
4W-1362B



HTA-6 Air/Liquid Bearing Processor

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FOREWORD

This technical proposal has been prepared to acquaint the U.S. Government with design criteria for an advanced continuous-film processor that incorporates several proprietary innovations. The design criteria in this document are based on the results of experience gained through experimentation, design, and production of air/liquid bearing photographic processing machines by personnel of the [redacted] 25X1

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CONTENTS

SECTION 1

INTRODUCTION

1.1 PROPOSAL SCOPE

This proposal contains information on design and production of the [redacted] HTA-6 Photographic-Film Processor, illustrated on the frontispiece. The design and production information will include: 25X1

1) Recommended engineering approach (Sections 2, 3, and 4)
2) Qualifications of personnel (Section 5)
3) Related experience (Appendix A).

[redacted] represents the HTA-6 design plan as being the most advanced approach for an aerial-reconnaissance duplicate-film processor. The design presumes that sensitometric control will have been accomplished in the printing of the original film. 25X1

1.2 HISTORICAL BACKGROUND

Several years ago, [redacted], an internationally-known authority on film-processor design, teamed with [redacted] to apply his new transport system and film-developing concept to aerial-film processing. These principles were employed first in Controllable Development Processor EH-49, a machine that used air and liquid bearings to "float" film through the various processing steps. Another development milestone, heat-shock processing, was incorporated in the machine as the control medium. 25X1 25X1

The fluid-bearing/vacuum-capstan methods were also incorporated in the HTA-5 Processor and the Levitron Processor, now in production. In addition, the principle has been employed in a wide-microfilm processor, and air-bearings are used in the ABD-4 Drier. As a result, [redacted] 25X1

with its subsidiary [redacted] is the only firm now successfully 25X1
manufacturing air/liquid bearing machines on a production basis. Further research in the use of the vacuum capstan as a transport vehicle is continuing with the EH-52 Processor, which utilizes heat-shock processing to develop aerial duplicating film in 1 second.

Much of the described research was accomplished under contract to build equipment to rigid specifications. Under company-sponsored research programs, [redacted] has progressed independently in 25X1
each of these areas and undertaken further studies in design, chemistry, and efficiency. This knowledge, coupled with today's advanced films, enables this Contractor to confidently claim achievement of a system that will outmode conventional wide-film processing techniques.

1.2.1 Company-Funded Research

The following [redacted] projects have a direct relation- 25X1
ship to this proposal:

1) Heat-shock Development: Even though heat-shock is not proposed for the HTA-6 Processor, these studies have pointed the way and have established parameters for processing today's film at temperatures above the generally accepted 68°F.

2) Ansco FPC-132 Tests: The HTA-6 is a black-and-white processor, not a color processor. However, [redacted] has done 25X1
extensive research on Anscochrome films. These color materials are, by reputation, one of the most delicate (if not the softest) films in use today. Some of the knowledge gained pertaining to chemistry and handling techniques can be applied to black-and-white processing with equal success.

3) Film Splicing: Although [redacted] has manufactured high-quality conventional film-splicers for many years, research has continued for better and quicker ways of splicing film. Among the many methods investigated are percussion, ultrasonic, heat, staple, and tape methods. The elevator-type accumulator proposed for the HTA-6 will permit the use of the reliable, time-proven manual film-splicer incorporated in many Houston Fearless film processors. 25X1

4) Air and Liquid Bearings: These innovations are described in detail in Section 2.

5) Pumps: To improve plumbing methods, [redacted] has selected a series of pumps that offers great ease of maintenance and efficiency. These pumps are designed so that they be disassembled in less than 1 minute. In addition, plenums can be rotated to any angle to accommodate connections. 25X1

6) Plumbing: Conventional piping and fittings incur wasteful line losses. These losses are so high, in fact, that previous wide-film air-and liquid-bearing machines have required massive service units. The reasons for the loss include rough interiors, poorly-sized joining sections, and badly-contoured elbows and tees. In addition, pockets created by mismatched connections were a prime source of potential contamination, which is contrary to the principle of cleanroom design. [redacted] will incorporate in this processor tubing and fittings similar to those used in the food industry. Plumbing used for piping liquid foods (milk, for example) must meet stringent sanitary specifications. There can be no corrosion, pockets, or offsets to trap potential bacteria-breeding particles. 25X1

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The use of such plumbing in the HTA-6 will provide substantial gains. Besides the cleanroom advantage, the increased efficiency will eliminate the complex service unit. Pumps, filters, and associated components can be located at the processor; this will also reduce line losses when service units are remotely installed.

[redacted] 25X1

1.4 TECHNICAL SUMMARY

The design proposed here is presented as the soundest approach to meet sensitometric, size, and economic requirements as [redacted] 25X1 knows them. Solutions to engineering problems are based on this contractor's past experience in producing air/liquid-bearing processing machines, data from in-house research and development, and from feedback from the users [redacted] equipment. 25X1

The novel transport features will permit high-quality processing of the most delicate types of film. Also, several important reliability and economic advantages are gained from the special geometry and materials proposed for the HTA-6.

Elimination of the separate service unit improves reliability and economy for the proposed application. Complex valving, lengthy plumbing

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lines, and the use of large pumps are avoided; for instance, to deliver solution in the required volume from a service unit just 10 feet away from the processor, 7.5-horsepower pumps must generate 45 psi of pressure, which degenerates to 3 psi at the bearing manifold. This loss is directly associated with the use of plastic, preformed-plumbing lines as well as distance. The interior surface of this type of line is inherently rough and uneven in diameter, causing substantial flow drag and stricture. With the proposed sanitary-type plumbing and with pumps and temperature-control integral with the tanks, significant savings will accrue through reduction of heat and pressure losses.

It has been estimated that the efficiency-gain factor will be about 15 percent better than other equipment in this class. Specific data will be developed during design testing.

SECTION 2

TECHNICAL DISCUSSION

2.1 DESCRIPTION

The air/liquid-bearing, wide-film HTA-6 processor will be a darkroom-operated machine capable of processing black-and-white duplicate film in any standard width from 70mm to 9-1/2 inches. The air/liquid-bearing principle, incorporated in the HTA-6 provides maximum protection from stress to the photographic film being processed, and will insure the highest quality product obtainable within the present state-of-the-art, consistent with proven methods and techniques. The machine will hold linear distortion of the film to the minimum and will eliminate the possibility of scratches or abrasions by avoiding physical contact between the film and the machine wherever possible. When physical contact does occur it will be slight and will be confined to the base side of the film. The film will be transported and processed without the emulsion side of the film contacting any portion of the machine. Every effort will be made to further minimize film stress by investigating all components in the film transport; for example, the possibility of driving the input spool will be considered.

At a minimum, the HTA-6 will be capable of processing film smoothly at speeds varying from 4 to 20 feet per minute. Film-transport speed will be variable over a range of zero to 40 feet per minute to accommodate future emulsions. Solution temperatures will be adjustable up to 85°F., this temperature being considered the highest practical working temperature at this time. Overall size of the processor will be 16 feet, 9 inches long by 8 feet, 3 inches high.

The sensitometric and physical properties of the film material processed in the HTA-6 will be those which are characteristic of such

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films as 8430 and 5427. The HTA-6 will handle both standard-base and thin-base materials (2.5 to 8.0 mils); however, no present requirement for thin-base film exists as the HTA-6 is designed for processing duplicate stock only.

2.2 HUMAN-FACTORS ENGINEERING

Careful consideration will be given to the construction, placement, and human engineering of the equipment and controls to obtain the simplest and most convenient operating conditions (Figure 2-1). The latest mechanical concepts for photographic-processing equipment will be included in the design. The plan for human-factors engineering is described in detail in Section 3.

2.3 CLEANROOM OPERATION

The proposed HTA-6 processor will be designed for cleanroom operation. All processing solutions, wash water, air for air bearings, and heated air for drier plenums will be filtered to 5 microns. Therefore, the potential hazard to high-resolution aerial images caused by large particles of dirt, dust, chemicals, and other image-degrading materials, will be eliminated.

2.4 FILM-TRANSPORT SYSTEM

The film-transport system will consist of vacuum-operated drive capstans and a number of air and liquid bearings over which the film will travel through and between immersion tanks.

2.4.1 Vacuum Capstans

Each vacuum capstan will consist of a polished stainless-steel sleeve which will rotate about a vacuum-chamber stop shaft. A significant feature of this type of film-drive capstan is the absence of any sliding friction between the rotating sleeve and the film, thus assuring maximum protection to the film.

The film-metering-drive vacuum capstan will be located at the end of the wash section at the film entrance to the drier. The film feed-in capstan will be located at the entrance to the wet section. The take-off-drive capstan will be located at film exit of the drier. Both the feed-in and the takeoff vacuum capstans will be slaved to the metering vacuum capstan so that they are automatically synchronized for the desired changes in transport speed. However, both vacuum rollers will have an override drive which will be governed for each unit by its film-loop sensing roller.

2.4.2 Air and Liquid Bearings

Air and liquid bearings will be used to transport the film through the processor. The following description is presented as a guide for persons unfamiliar with this principle of film transport.

Air or liquid bearings consist of tubes into which air or liquid is pumped. The air or fluid is allowed to escape from the tubes at a controlled rate through escape slots of definite sizes, thus forming a cushion of liquid or air on which the film is borne. The configuration of the slots will provide even film development. The fully concentric film path is achieved through two turbulation zones, which, in turn, are created by four angled escape orifices. The desired height of the liquid or air cushion is controlled by the shape and particular design of the two bleed rings which define the film path.

In the chemical solution and wash sections, liquid bearings are submerged in the tanks. Air bearings above the processor tanks provide intertank transport. The drier is equipped with air bearings and controlled-temperature air is blown through them for film drying as well as for film transport.

2.4.3 Bearing Flange Adjustment

Primary design considerations for bearing flange adjustment include ease of adjustment, proper liquid- or air-cushion levels, reliability and secure film positioning. The design selected will permit liquid and air-bearing bleed rings to be manually adjusted to the width of the film being processed. Bleed rings will be indexed to selected positions and secured by a detent. This will establish a proper cushion in the liquid and air bearings and will insure precise film-strip tracking.

Other mechanical devices for bleed-ring indexing are being studied. One uses a lead screw manually-operated by a hand crank. The crank can be rotated to specific markings denoting film size. Another device employs a rack and pinion gear, with bleed rings attached to opposing racks and driven through a pinion by a hand crank which requires less than 360 degrees of rotation for the full range of film sizes.

2.4.4 Variable Speed Control

The transport rate of the processor will be variable over a range of zero to 40 feet per minute. Speed variation will be obtained by manually adjusting the speed control which, in turn, controls the operating speed of the metering vacuum-capstan drive.

2.5 CONSTRUCTION

Modular construction will be used wherever possible for ease of maintenance, assembly, and disassembly. Each of the separate sections of the processor will be mounted on a base frame of stainless-steel channel. All joints in the stainless steel will be heliarc-welded; the welds will be ground, polished, and passivated. Structural partitions will generally be fabricated of stainless steel. Where contact with photographic solutions is necessary or probable, Type 316 stainless steel or a suitable plastic material will be employed. All control panels, subassemblies, and components will be wired so that they can be individually removed from the machine.

2.6 LOADING STATION

The loading station will incorporate the loading table, a film-splicing unit, and a supply of leader material. This module will be fitted with standard access panels so that the interior of any portion of the loading station is readily accessible for maintenance.

2.6.1 Loading Table

The loading table will be designed to accept a standard film spool for loading the machine. Spool capacity is 1000 feet for standard base or 1800 feet for thin-base film. The end of this loading table may be equipped with registration pins and mating surfaces to accept a [redacted] 5000-foot film cart. Integral with the loading table will be an alarm system which will warn the operator when approximately 40 feet of film remains on the spool. The alarm will be adjustable (from the control panel) to any desired film length, thus allowing the desired time for obtaining a new supply of film or leader. 25X1

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2.6.2 Splicing Unit

The film-splicing unit will be mounted on the loading table. This tape splicer will be similar to that used on many [redacted] 25X1 processors, but will incorporate several new features for making faster and more precise butt splices. To cut the film, the operator first lowers and latches two film-locking bars which secure the film firmly on the cutting surface over the cutting groove. The operator then lowers and latches a cutting bar which consists of a retractable blade assembly that moves laterally across the film on two metal ways. The operator presses the blade into the film with the blade pushbutton and draws the assembly across the film. The cutting bar and the film-locking bar are then raised and the spool is removed. The operator locks the new film-end in place and butt-splices it to the processor film-end with tape from the splicer-unit tape supply. The entire splicing operating can be performed in 30 seconds or less.

A supply of leader material for threading the machine will also be located on top of the loading station.

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2.7 PROCESSING SECTION

The processing section will have six immersion tanks: one for developer, one for stopbath (or rinse), one for fixer, and three for was.. These tanks will be in the relative positions indicated in Figure 2-1

All processing tanks will be provided with overflow outlets and bottom drains.

Each tank will contain a heat exchanger which will act at the same rate as the flow equalizer that is used for the liquid-bearing recirculation system.

The temperature-control unit consists of a small stainless-steel container in which are mounted an electric heater and a solenoid-controlled valve cold-water inlet. A circulation pump is connected between this tank and the heat exchangers mounted in the tank units.

The temperature-control unit is filled with approximately 1 gallon of water, which is the medium for the temperature changes to the high or low side when circulated by the pump.

The electric heater in the temperature-control unit will heat the circulated water until the desired processing temperature in the developer tank is reached. At this point the thermostatic controls open the cold-water solenoid valve on the temperature-control unit and allow cold water to enter, which in turn mixes with the 1 gallon of rapidly-circulated water. An overflow is provided on the tank unit. During this cycle the immersion heater is energized constantly. This unique but very simple control system produces, with an accuracy of $\pm 0.25^{\circ}F$, a temperature curve with no overriding characteristics.

The reliability of our proposed temperature-control system is well proven, and is in use with process equipment with 24-hour duty cycles.

Each of the tanks in the processing section will contain liquid bearings as described in Subsection 2.4.2. Air bearings of the type described in Subsection 2.4.2 will be provided at the entrance and exit of each of these tanks to permit film transport from tank to tank without mechanical contact with machine parts.

Film is threaded by attaching the film leader to a mylar belt with a special clamping device. The belt rides over idler pulleys located at the end of the bearings and passes over and under individual tank bearings. The belt is pulled manually through each tank until the leader has threaded film over and under all bearings.

A cascade wash-system within the three wash tanks will provide archival wash (hot and cold water to be provided at the installation). Tempered water will be supplied through a thermostat-controlled mixing valve capable of controlling wash-water temperature within $\pm 2.5^{\circ}F$. The wash-water consumption will be about 50 percent less than that of conventional processors due to the Levitron high turbulation effect which allows a much more economical use of water.

In this wash system, fresh, pressurized water is forcibly ejected in jets from each bearing and impinges directly on the film surfaces, carrying residual sodium thiosulphate with it. The water first enters the final wash tank and is then pumped into the first wash tank. Part of the water can be pumped from the first wash tank to the developer rinse tank. Because of the cascade wash and use of the Levitron impingement principle, this wash system will require only about 50 percent of the water needed in conventional processors.

A wetting agent will be contained in a small vessel located after the final wash tank. Provisions will be made to permit controlled gravity-feeding of the wetting agent into the final rinse.

The wet section of the HTA-6 will have a manually-operated self-threading system. The splicer and the drier will be hand-threaded.

2.8 AIR SQUEEGEE

An air squeegee will be located just above the wetting-agent tank and ahead of the drier. The squeegee will remove excess moisture from the film material to insure uniform and rapid drying of the film material. A low-pressure, high-volume, Super Levitron-typė squeegee will be employed. This unit has been used on the HTA-5 with excellent results. A separate blower for the squeegee will be incorporated, if necessary.

2.9 DRIER SECTION

The drier will be housed in a separate cabinet into which processed film from the wet section is fed by a positive-drive vacuum capstan.

The drier will be accessible through a full-length plexiglass door. Upon entering the drier, the film will be threaded around air-bearing plenums (as shown in Figure 2-1) with adjustable bleed rings to accommodate films of various widths. The drier has a closed air-circulating system and maintains a slight positive pressure while in operation to prevent unfiltered air from entering the system. A damper control provides infinitely variable control over recirculated air and permits proportional addition of 5-micron filtered fresh air.

The film will make no mechanical contact as it passes over the air bearings, as it will ride on a cushion of air. The air bearing will be mounted in a fixed position on the back wall of the drier.

Electrically-heated and thermostatically-controlled air will be ducted into each plenum. The air will impinge uniformly on the film eliminating areas of uneven drying which might result in marks and density variations. A single air-blower will be used for all drier bearings.

Overall drier temperature will be controlled from the same central control-console used for temperature control of chemical solutions. Maximum safe temperature may be controlled from manually-set thermostats in the drier itself.

The drier will be a self-sufficient unit in the sense that no external blowers, filters, or ducting to any outside source are required.

As the film comes off the bottom air-bearing plenum it will form a loop around a loop-sensing (polyethylene) roller. The position of this loop-sensing roller controls the override drive of the vacuum-capstan at the exit of the drier.

This system extends impingement drying to its ultimate efficiency, making the air serve the dual purpose of film drying and film transport. Due to its efficiency, this drier will dry film at lower temperatures than any conventional drier.

The drying system will be arranged so that a dehydrator (not included in this proposal) may be used if a cold-air drying system is desired.

A normalizing chamber through which the film passes as it leaves the drier will also be provided.

2.10 TAKEUP STATION

As the film emerges from the drier it will pass in front of a film viewer for inspection prior to being rolled on one of the two takeup reels (frontispiece). The viewing panel will be properly light-filtered and illuminated. This panel will be provided with a voltage control to permit adjustment of light emission, and with sliding shutters adjustable to the width of the film. The takeup assembly will consist of two shafts which will accommodate all 1000-foot Class B reels.

The takeup station will also include a device to dissipate electrostatic charges from the film.

Two film-cutter bars will be included at the takeup station for cutting film while changing from one takeup reel to another. The cutter bars will have small light boxes located directly below them. The light boxes will provide narrow bands of light along the cutter edge and will allow the machine operator to locate easily the line to be cut.

2.11 CENTRAL CONTROL PANEL

The central control panel will be located at the takeup end of the processor as shown in Figure 2-1. The controls are located in this position to prevent fogging the film when operating the machine in the darkroom, to centralize all controls, and to prevent damaging control-console cabinets with film carts or magazines.

NOTE

> Duplicate START-STOP controls will be located at the load end.

The controls, which will be arranged to sequence operations in a normal left-to-right, top-to-bottom arrangement, will be designed for darkroom operation to take care of any emergency conditions. The control provisions will include the following features:

1) Switches will be tactile-coded so that the switch mode can be sensed by touching the control before actuating it.

2) The recessed control panel will be illuminated by miniature edge lights. A dimmer switch will provide intensity control.

3) All indicator lights will be provided with iris shutters to adjust the light emission to a safe level.

4) Controls will be mounted on the panel in an arrangement that will tend to reduce errors caused by actuating improper controls in the darkroom; for example, when the START button is depressed, it will remain flush with the panel so that the STOP button, protruding above the panel, becomes the only control in the area that is available for actuation.

5) Electrical interlocks will be incorporated in all cases where damage to the film or the machine, or the safety of personnel, is involved.

Final arrangements of all control elements, visual indicators, and audible alarms will be based on a human-factors engineering study. All

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power requirements for the machine itself will be brought to the area from the rear and below the control panel for distribution to specific equipment. Also located in the control panel area will be the overload-protection circuits, power interlocks, temperature controllers, speed-control units, and the audible alarms.

2.12 TEMPERATURE CONTROL

Solution-temperature control will be maintained within ±0.5°F up to 85°F. (The customer must furnish water at 10 gallons per minute and at a temperature of 45°F.) The tank-solution temperature will be controlled by solid-state electronic circuitry that is capable of reacting speedily to out-of-tolerance solution-temperature conditions.

An automatic water-temperature blending valve will be used to control the wash-water temperature to within ±2.5°F.

Drier-temperature control will be accomplished by a solid-state device similar to that used for the processing-solution control.

Temperature sensors will be properly located in the processing solution tanks and the drier to provide data to the control circuits. The probe in the wash section will be used for monitoring only.

2.13 ELECTRICAL CHARACTERISTICS

The electrical system will require a 120/208-volt ac, 3-phase, 4-wire electric power source at the processor main power-distribution box. This system will provide the following safe operating conditions:

1) All indicator and warning lights except main power lights will be off when the machine is running satisfactorily.

2) All liquid pumps will be provided with a time-delay relay circuit so that the pump will switch off automatically in the event of a dry line.

3) When end-of-film warning is received, the takeoff-drive capstan will be switched off but the vacuum pump will remain on to hold the end of the film.

4) The drier-blower circuit will incorporate an interlock circuit to prevent heater elements from operating when the blower is not running.

2.14 RELIABILITY

With several air/liquid bearing processors now in the field or undergoing factory testing, meaningful reliability data are now available. Life tests and statistical models have indicated a continuous processing capability exceeding 72 hours. This reliability has been achieved through keeping moving parts to a minimum and through careful selection of purchased parts. All parts are NEMA-rated for industrial or commercial use. In the HTA-6 program, additional achievements are expected to minimize mean-time-between-failures and maximize mean-time-to-repair.

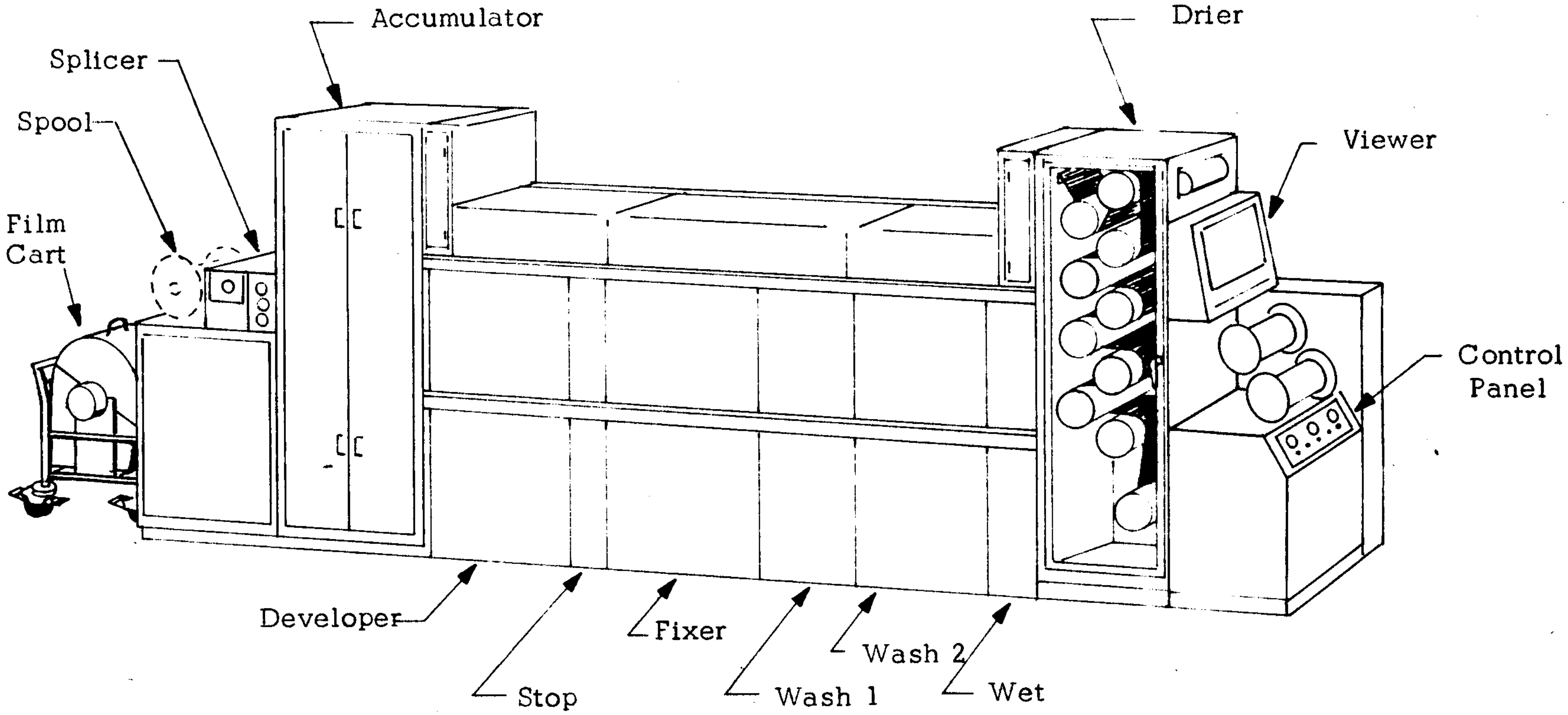

Figure 2-1. HTA-6 Air/Liquid Bearing Processor

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SECTION 3
HUMAN-FACTORS ENGINEERING

3.1 HUMAN-FACTORS CONSIDERATIONS

[redacted] plans to implement those human factors principles 25X1
that will insure the engineering of equipment that is easy to operate and maintain. This Contractor has had considerable experience in the design and fabrication of equipment that involves critical man-machine relationships concerned with physical and psychophysical analysis.

3.2 MACHINE DESIGN

During the design phase, consideration will be given to the arrangement of all components with respect to operational and maintenance requirements of operator groups within the 5th and 95th percentiles.

Control groupings will be consistent with basic operational sequences and frequency-of-use parameters.

Initiation of the program of development design of the machine will include developing a program with flow charts for operational, malfunction, and emergency procedures as guidelines of machine layout; verifying film-loading and takeup heights; determining optimum film-viewing configuration; evaluating machine-component accessibility for servicing and maintenance; and evaluating control and display components to determine specific control layouts.

The main control panel will be located on the front of the machine adjacent to the takeup station. It will be tilted to provide good visibility for 5th through 95th percentile operators. All controls and displays will be readily accessible to the operator.

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SECTION 4

PROGRAM

In accordance with standard [redacted] design objectives, the processor will represent the best engineering practice and will incorporate components, methods, and materials of proven merit. Upon contract award, [redacted] will design, fabricate, test, and deliver one complete Model HTA-6 film processor as described in Section 2. 25X1 25X1

The equipment progress will be monitored and reviewed on a continuing basis by the Contractor's project engineers. In addition, government personnel or consulting engineers employed by the government may visit the Contractor's facility for evaluation of the work being carried on under the terms of this contract. The contractor will insure that technical coordination is achieved with such representatives on a mutually agreeable schedule.

The [redacted] maintains a single-standard quality-control system that meets the requirements of MIL-Q-9858 and Air Force Bulletin Nos. 515 and 520. The system includes control of raw material, receiving inspection, in-process and final-test inspection, written inspection and test procedures, calibration of testing and measurement equipment, and complete, written, quality-control operating procedures. The system has been surveyed and approved by both the military and prime contractors to the military. 25X1

The quality control department manager reports directly to the General Manager, and the department is adequately staffed to assure compliance with the written procedures.

SECTION 5

PHOTOGRAPHIC SYSTEMS GROUP PERSONNEL

A profile of the technical staff of the photographic systems group shows a broadly diversified spectrum of experience in the photographic sciences, physics, and mechanical engineering. A review of significant staff contributions of original ideas, concepts, new applications, and products includes such areas as:

Special-purpose film processor design	Sensitometry
Optical radiometry	Photometry
Mechanical structures and systems	Corrosive-chemical circulation systems
Information theory	Miniaturization techniques
Electronic image enhancement	Microwave-energy film development
Photographic laboratory design	Special-purpose cameras and camera control
Optical system design and construction	Black-body light-measuring instrumentation

Materials processing systems

Appendix A contains examples of typical related equipment which [redacted] personnel have designed and manufactured. 25X1

The success of the photographic systems group has vindicated its technical staffing policies: a nucleus of senior engineers complemented by their intermediate and junior counterparts selected for originality, creative potential, and initiative. The resumes in this section highlight the backgrounds of those people who will be available for technical and administrative support and to whom key project responsibility will be delegated.

The overall technical and administrative activity will be supervised [redacted] 25X1
[redacted] as project manager, will have technical and administrative control within the project. 25X1

[redacted] will be responsible for the sensitometric problems; 25X1
Howard Speer will be responsible for mechanical design. [redacted] 25X1
will be in charge of installation and field services at the customer's facility, and Alphonse Merino will contribute to the human-engineering aspects of the processor design. [redacted] 25X1
will participate in a consulting capacity.

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APPENDIX A

RELATED EXPERIENCE

During the more than 25 years that [redacted] has been a leader in the photographic-processor field, most areas related to the field have been explored by the company. A few of the related film-processing system programs successfully completed by [redacted] are described in the following pages.

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HTA-5 PHOTOGRAPHIC FILM PROCESSOR

The HTA-5 Processor automatically processes black and white photographic films commonly used by the Air Force for aerial photography and for reproduction purposes.

The HTA-5 provides maximum protection to the processed film and insures the highest quality product obtainable within the present state-of-the-art. Linear distortion of film is held to the minimum and the possibility of film damage is reduced by limiting contact between the film and the machine. The HTA-5 also offers exceptional reliability, continuous operation for long periods, and ease of operation and maintenance.

Designed and built to the highest commercial standards, the HTA-5 is capable of processing standard or thin-base black-and-white films in any width between 70mm and 9-1/2 inches and will accept film magazines or reels containing a maximum length of 20,000 feet. Processing speeds vary smoothly over a range of 4 to 25 feet per minute. The film transport speed ranges from 4 to 60 feet per minute to accommodate future emulsions. Film is transported through the HTA-5 by a vacuum-capstan film drive using air and liquid bearings. This drive provides smooth operation and delivers processed film free from scratches, abrasions, or distortions.

Ease of operation and maintenance are characteristic of the HTA-5 processor. Provisions are made for handling bulky, heavy rolls or magazines with mechanized assistance, for simple loading and threading, for rapid and easy splicing, and for rapid draining and filling of tanks. Maintenance is facilitated by modular construction, by components and assemblies that can be removed and replaced easily, and by appropriate fail-safe indicators and alarms.

AUTOMATED FILM PROCESSORS

[redacted] is building a unique controllable-development film processor for the United States Air Force. 25X1
The machine incorporates much design rationale applicable to the proposed program in terms of precision, reliability, and human engineering. Because it handles irreplaceable film whose processing is exacting, operational reliability is a prominent design consideration. Similarly, special design consideration is given to selection of materials and fabrication techniques compatible with cleanroom operation.

The processor monitors film development by infrared scanning, and automatically varies the development schedule to provide optimum processing parameters for each frame according to its particular exposure. The machine also records the values of the processing parameters for each frame according to its particular exposure and to give a measure of the conditions under which the film was exposed.

The film is transported through the processor on specially-designed [redacted] air and liquid bearings. These bearings eliminate contact 25X1
between the film and the machine, thus preventing damage to the film emulsion through scraping or stretching. The control console contains a built-in closed-circuit TV system for remote monitoring.

The controllable-development processor is the first of its kind; no other machine presently on the market offers continuously-controlled development under remote surveillance.

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