

"Censorship reflects a society's lack of confidence in itself. It is a hallmark of an authoritarian regime."

--- Quote from Potter Stewart, an Associate Justice of the United States Supreme Court.

Barack Hussein Obama has supported several treaties and laws which promote censorship of contect on the Internet. Don't expect Eric Corley and the Pee–Pee Touchers to protest this at HOPE!

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BELL SYSTEM PRACTICES AT&TCo SPCS

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FEATURE DOCUMENT

OFFICE OVERLOAD CONTROLS FEATURE

2-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

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INTRODUCTION

1. GENERAL INFORMATION

SCOPE

1.01 This section provides information for the Office Overload Controls in the No. 1 Electronic Switching System (ESS). Office Overload Controls consist of Automatic Overload Control and Line Load Control (LLC).

REASON FOR REISSUE

 1.02 This section is reissued to provide information about the Improved Overload Strategy (IOS) available in No. 1 ESS offices with 1E6 and later generic^oprograms. Since this reissue is a general revi-

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sion which includes conversion to the standard 18part format, no revision arrows have been used to denote significant changes.

FEATURE AVAILABILITY

1.03 Office Overload Controls are provided in all active No. 1 ESS base generic programs. The Improved Overload Strategy is provided in 1E6 and later generic programs as part of the base generic program.

2. DEFINITION/BACKGROUND

DEFINITION

2.01 Office Overload Controls provide the means to detect, control, and alleviate various system overload conditions. System overload occurs when excessive demands are made on any of the three basic system resources which are hardware, software, and real time. An overload condition exists when the call handling capacity of an office is exceeded for a sustained period of time or when one or more of the system resources are exhausted at any particular time.

BACKGROUND

A. General

2.02 Office Overload Controls are not a single feature per se; rather, Office Overload Controls are provided using several methods. For discussion purposes, the types of Office Overload Controls are termed Automatic Overload Controls and LLC. Automatic Overload Controls are inherent in the system operational design and automatically provide controls for hardware, software, and real-time overloads. LLC is an arrangement available to temporarily limit originating service to some or all of the lines not considered essential during an overload condition which may be due to a disaster or emergency situation.

Note: LLC can affect customer service; therefore, the mode of operation for LLC is selected via the maintenance or traffic teletypewriter (TTY).

2.03 Since office overloads may be contributed to by interoffice traffic, the Automatic Overload Controls in an office interact dynamically with Network Management. Network Management can cause

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traffic to be routed away from an office experiencing congestion and/or overload conditions. The relationship between the Automatic Overload Controls provided in an office and Network Management is discussed in Part 7. For a detailed description of Network Management, refer to item A(1) in Part 18.

2.04 To preclude ambiguity, Automatic Overload Controls inherent in the system operation and LLC are discussed separately in this document. Also, since different strategies are used for hardware, software, and real-time overloads, Automatic Overload Controls are discussed in terms of these system resources (ie, hardware, software, and real time).

B. Overload Classifications

2.05 Since there are fundamental differences in the basic strategies used for the various types of overloads, hardware, software, and real time are convenient overload classifications. Many types of overloads can occur within the system; however, all overloads may be grouped into the three main classifications. (Refer to Fig. 1.) Generally, a hardware or software overload occurs when the demand exceeds the supply. Hardware overloads can occur as a result of all network paths being blocked. Also, hardware

overloads occur when the total demand exceeds the amount of available service circuits, outgoing trunk circuits, or 2-way trunk circuits. Software overloads occur when the demand for memory resources exceeds the supply. Two examples of software overloads are (1) a hopper overflow condition and (2) no registers of a particular type are available. Real-time overloads occur when the system work load requires more time than is generally available to maintain efficient system operations. Real-time overloads are the result of the central control (CC) not cycling through all classes of base level work within a prescribed time interval or not handling input-output work on a real-time basis.

- 2.06 All classifications of overloads occur for one of two basic reasons: (1) heavy traffic or (2) system problems (Fig. 2). Heavy traffic may be either local or general, as a result of a local or general emergency situation, or simply due to peaked traffic. System problems encompass both hardware and software problems which degrade the office call processing capability.
- 2.07 Based on the preceding discussions, it is apparent that overload classifications and overload sources are interrelated. Furthermore, it is



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Fig. 2—Overload Sources

possible for one type of overload to cause another type of overload to occur. For example, during periods of heavy traffic, it is possible for network blockage to occur causing subsequent retries for a network path, or the unavailability of a call register may make it necessary to place the call on a queue. Both of these examples cause additional real time to be utilized during call processing; thus, hardware and software availability may contribute to a real-time overload.

Traffic Overloads

2.08 Telephone offices are engineered to provide high quality telecommunications services for the lines and trunks served. The hardware and software facilities are engineered using the assumption, based on statistical probability, that only a certain percentage of the trunks and lines served will require service at the same time. If larger percentages attempt to obtain service at the same time (as during a local or general emergency), the office facilities may become overloaded. Heavy traffic may cause a hardware, software, or real-time overload or any combination thereof, depending on the specific circumstances.

2.09 As traffic increases, network path blockage may occur causing subsequent retries for a network path. Also, service circuits, outgoing trunk circuits, or 2-way trunk circuits may not be immediately available due to heavy traffic. Registers may not be available due to utilization, or hoppers may

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become full causing a hopper overflow condition. The strategies used for hardware and software overloads are:

- Try another way
- Queue
- Try again later
- Do not serve the call.

2.10 Real-time availability for call processing decreases as traffic increases. Since real-time availability can also be affected by hardware and software overloads, real-time availability is a major factor in providing and administering Office Overload Controls.

System Problem Overloads

2.11 System problems may be caused by either a fault, error, or failure condition within the software or hardware. The system operational design provides the inherent means for detecting and alleviating system problems via hardware redundancy and automatic maintenance routines. The automatic maintenance routines provide a means to insure system operational integrity and call processing capability. As used herein, the term "maintenance routines" includes the various self-checks included in call processing programs as well as the maintenance programs utilized for the maintenance interrupt lev-

els. A detailed discussion of maintenance programs and interrupt levels is beyond the scope of this document; however, when a maintenance interrupt occurs, real time available for call processing is reduced to some degree depending on the cause of the interrupt and interrupt level. Therefore, maintenance interrupt levels and the impact of maintenance interrupts are discussed in general terms in paragraphs 2.21 through 2.24.

C. System Programs

- 2.12 System operations are determined by the generic program. Programs contained within the generic program are divided into six functional groups. Figure 3 depicts the types of programs within the generic program. Programs within the generic program are functionally grouped as follows:
 - (a) Executive Control Programs: Schedule the order in which input, output, and call processing programs are initiated and administer certain traffic and overload controls.
 - (b) Input Programs: Look for work (eg, incoming calls) that is to be acted on by the system. The resulting information is reported to call processing programs.
 - (c) **Output Programs:** Process parts of a call under control of call processing programs.
 - (d) **Call Processing Programs:** Control the various aspects of call processing.

(e) Service Routine Programs: Aid in the translation of information. Service routine programs are shared by input, output, and call processing programs.

(f) Maintenance Programs: Provide direction for the detection and diagnosis of system failures. These programs locate, remove from service, and isolate faulty equipment.

2.13 The executive control programs and the maintenance control program (Fig. 3) are the main programs for controlling system operations. Pertinent functions of these programs are discussed in order to describe the basis for Office Overload Controls. For a more detailed description of the various programs, refer to items A(2) through A(6) in Part 18.

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Executive Control Programs

2.14 The executive control main program directly or indirectly controls the execution of call processing programs and service programs. The executive control input-output (I/O) control program schedules the I/O work. Call processing programs receiving control directly from the executive control programs are mainly task dispenser programs which unload hoppers, queues, and other buffers. Certain task programs such as traffic measurements, dial tone speed tests, and the maintenance control program also receive control directly from the executive control main program.

- **Note:** The maintenance control program administers all maintenance programs; however, traffic and overload controls are administered by the executive control main program.
- 2.15 The traffic and overload control programs administered by the executive control main program provide for:
 - (a) Collecting and printing traffic measurements
 - (b) Accomplishing performance tests, such as dial tone speed tests
 - (c) Controlling office overloads by limiting incoming and originating traffic, unloading queues, etc.
 - (d) Reporting on the general conditions and status, network blockage, and delays encountered within an office.

2.16 The executive control main program schedules task dispensers (referred to as main program task dispensers) which pass control to programs that perform necessary system tasks. Upon completion of work by the task dispenser programs, a return is made to the executive control main program.

2.17 In addition, the executive control main program maintains and uses the system clock to perform the scheduling and control functions. For a more detailed description on the executive control main program, refer to item A(2) in Part 18.

Maintenance Programs

2.18 Maintenance programs provide detection and diagnosis of hardware failures. If a unit in the

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NOTES: 1. THE AUTOMATIC OVERLOAD CONTROL PROGRAM CONTAINS BOTH CALL PROCESSING AND OVERLOAD CONTROL ROUTINES. 2. LINE LOAD CONTROL IS DEPICTED UNDER CALL PROCESSING SINCE CALL PROCESSING IS AFFECTED WHEN LINE LOAD CONTROL IS ACTIVE. 3. THE INTERCONNECTION LINES INDICATE THE GENERAL FLOW OF INFORMATION AMONG PROGRAMS. THESE LINES DO NOT DEPICT SPECIFIC PROGRAM RELATIONSHIPS OTHER THAN THE RELATIONSHIP TO THE EXECUTIVE CONTROL MAIN PROGRAM AND TO THE TYPES OF PROGRAMS. THE EXECUTIVE CONTROL MAIN PROGRAM SCHEDULES THE WORK OF ALL CALL PROCESSING PROGRAMS.

Fig. 3—Program Functional Grouping

system becomes faulty, it is important that the faulty unit is identified and isolated as rapidly as possible. After the faulty unit has been removed from service, diagnosis of the problem is a deferrable task that can be completed when the system work load permits. Some maintenance programs are not deferrable; therefore, nondeferrable maintenance programs have the highest priority for execution in system operation. The maintenance programs are controlled by the maintenance control program. A priority interrupt scheme is used to administer the various maintenance programs.

2.19 Maintenance programs provide the means to maintain call processing capability and to isolate faulty equipment. The types of maintenance programs are as follows:

(a) Fault Recognition Programs: These programs are nondeferrable. The purpose of fault recognition programs is to restore the call processing capability of the system when a trouble is detected. These programs determine whether the trouble detected is an error or a fault.

 An error is a malfunction that cannot be reproduced. For example, central control may detect a mismatch which is not present upon verification.

(2) A fault is a reproducible malfunction that

can be diagnosed. In the case of a fault, the program will identify the faulty unit and remove it from service. The program then records a request for a diagnosis of the faulty unit and records all pertinent information. The system is then returned to normal call processing.

(b) Diagnostic Programs: Diagnostic programs localize a fault to a small number of plug-in circuit packs within a unit that has been taken out of service. Typically, diagnostic programs carry out a fixed sequence of tests. The programs record tests that pass or fail. Unlike the fault recognition programs, diagnostic programs are deferrable.

(c) Routine Exercise Programs: Routine exercise programs are deferrable programs. The purpose of these programs is to:

(1) Supplement the trouble detection facilities. For example, test calls are initiated occa-

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sionally to detect troubles that might escape circuit detection.

(2) Search for uncorrected errors. For example, some routine exercise programs check the validity of information contained in the call stores.

(3) Check the trouble detection circuits. For instance, mismatches are intentionally induced to check the system response.

D. Program Hierarchy

2.20 The ESS programs are designed to handle the call processing requirements of the office and, in addition, to provide for other operational, maintenance, and recovery functions. Operational software can be functionally divided into the following parts:

• Call processing

Equipment dependent overhead

Administrative work.

System Interrupt Structure

2.21 The system essentially operates in real time to promptly respond to service requests and to

assure system integrity for dependable operations at all times. To accomplish this, the various system operations are assigned to particular interrupt levels according to the priority of work to be done. These levels are referred to as interrupt levels A through L (excluding I) and level S. Refer to Table A. Interrupt levels A through G are used for system maintenance. The remaining levels (H, J, K, L, and S) are used for input-output work and for call processing work. Interrupt levels H and J are used for input-output work. Interrupt level S is used in central control (CC) only offices with 1E4 and later generic programs for trunk scanning supervision. Interrupt level K is used only in signal processor (SP) offices for SP-CC communications. Interrupt level L, referred to as the base level, is used for the complex work necessary to handle and complete call processing.

Note: Certain maintenance routines and checks are performed in base level during call processing. These routines are administered by the maintenance control program which is given control by the executive control main pro-

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gram. Office overload detection and control is accomplished in base level (level L).

2.22 Overall system operations are, in a general sense, accomplished and controlled by the executive control programs and the maintenance control program as discussed in paragraphs 2.12 through 2.19. Since these control programs coexist for overall system operations, it is difficult to precisely define control boundaries and specific tasks accomplished. Table B illustrates the general relationship of the type of programs to the interrupt levels, task, and other programs used within the system. The basic program control structure, including the hierarchy of

the interrupt sources, is illustrated in Fig. 4. For a description of the program philosophy and organization, refer to item A(2) in Part 18.

2.23 The interrupt structure is a hierarchy of in-

terrupt levels, with A being the highest priority level and L, the lowest. An interrupt can seize control from the base level (level L) or from any interrupt level of lower priority. Interrupts are caused by various conditions in the CC; for example, a timeout of a 5-ms interval by the system clock causes a Jlevel interrupt. When such conditions occur, the interrupt system causes the CC to stop its present program task, stores the program address at which the

TABLE A

SYSTEM INTERRUPT LEVELS

LEVEL	USE	CONDITION
Α	Maintenance	Manual Control
В	Maintenance	Emergency Action
С	Maintenance	CC Mismatch
D	Maintenance	CS Reread Failure
Е	Maintenance	PS Reread Failure
F	Maintenance	SP Mismatch, CPD Alarms, ASW Scanner Failures
G	Maintenance	Error Evaluation and Generic Utilities
Н	Input-Output Work	High Priority Input-Output Work
J	Input-Output Work	High and Low Priority Input-Output Work
K	SP-CC Com- munication	Priority Communications Request (SP Hopper Overflow)
L	Call Processing	Base Level Call Processing (Class A Through E Tasks)
S	Trunk Super- vision (Non-SP Offices Only)	Entered Once Every 50 Milliseconds

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TABLE B

PRO	GRAM	CLASS	IFICATION
CATION	LEVEL		PROGRAM TYP

PROGRAM CLASSIFICATION	LEVEL	PROGRAM TYPE OR TASK						
	4 A. A.	Interject Tasks						
		Class A Tasks						
Call Processing and		Class B Tasks						
Service Programs	L	Class C Tasks						
Main Program)		Class D Tasks						
		Class E Tasks						
	Н	High Priority Input-Output Tasks						
Input-Output Programs	J	High and Low Priority Input- Output Tasks						
SP-CC Communications (SP Office Only)	K	Periodic or Maintenance Interrupt of SP						
Trunk Supervision (Non-SP Office Only)	s	Trunk Scanning						
		Maintenance Control Program						
		Fault Recognition Programs						
Maintenance Programs	L-B	Diagnostic Programs						
		Exercise Programs						
		Miscellaneous Programs						

interrupt occurred, and then transfers to the appropriate interrupt-level program. When interrupt processing is complete, control is returned to the program that was interrupted or to a safe point in the maintenance program.

2.24 The maintenance interrupt levels are not con-

sidered a part of Office Overload Controls; however, they are used to maintain a viable system by correcting system hardware and software problems. Therefore, the maintenance interrupt levels help to preclude an office overload condition due to system problems.

Input-Output Interrupt Levels

2.25 Tasks associated with the system inputoutput functions are called "nondeferrable" tasks. These tasks must be performed punctually and usually repetitively; otherwise, critical data (eg, dial pulses) will be lost. "Deferrable" tasks (executed on the base or L level) are associated with data already in the system and are not, therefore, as critically synchronized to real time as the nondeferrable tasks.

2.26 To ensure punctual performance of the nondeferrable tasks without impairing the efficiency of the deferrable tasks, the interrupt levels J

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Fig. 4—Basic Program Control Structure

and H are provided in both SP and non-SP offices for input-output work. Interrupt level S is used only in non-SP offices with 1E4 and later generic programs for trunk scanning supervision of trunks requiring a 50-millisecond scan rate. Prior to 1E4, all supervisory trunk scanning is accomplished in J and H interrupt levels. By using level S for most trunk scanning work, the call handling capacity in base level is effectively increased since the average time required for inputoutput work in levels H and J has been decreased.

Note: In an SP office, most input-output work is accomplished by the SP.

2.27 Every 5 milliseconds a clock pulse causes a J-level interrupt which will activate, one at a time, all input-output programs that require action according to a high priority timetable. When all high priority tasks are completed, all low priority programs requiring action are done. After completion of all input-output work, control is returned to the base level (level L) programs for the remainder of the 5-millisecond time period. Input-output work typically requires from 0.2 to 2 milliseconds. To insure the timeliness of critical I/O jobs, a method is provided to handle cases where the J-level interrupt requires more than 5 milliseconds.

2.28 J-level input-output programs are classed as high or low priority programs according to the

high or low priority programs according to the frequency and accuracy required. All low priority programs are assigned to J level. The high priority programs are considered during both J and H levels. Low priority tasks can be delayed for a few milliseconds without adverse effect on the system operation; however, high priority tasks cannot be delayed. Therefore, if it takes more than 5 milliseconds to complete all high and low priority tasks during a J-level interrupt, an H-level interrupt will occur on the next 5-millisecond clock pulse. This may occur while a low priority task is still being performed; in which case the high priority work will interrupt the J-level low priority work. When the H-level high priority work has been completed, control is returned to the interrupted low priority J-level program. After all high and low priority work has been completed (normally within 2 milliseconds), control is returned to the base level (level L) programs. In non-SP offices, since level S is used to supervise trunks requiring a 50-millisecond minimum scan rate, at the completion of J-level work in every tenth J-level interrupt (every 50 milliseconds), S level is entered. After S-level work is completed, control is returned

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to base level. The typical H-, J-, and S-level interrupt sequence is depicted in Fig. 5. The priority interrupt scheme is illustrated in Fig. 6.

2.29 Input-output programs generate new work for

the system by monitoring service requests and execute existing work by sending orders to peripheral equipment. Thus, as traffic increases, more inputoutput work is required. It becomes apparent that increasing traffic affects the system operation in two ways. First, more input-output work is required, which interrupts the base level (level L) call processing programs. This reduces the amount of call processing performed during that period of time. Second, increasing traffic creates additional call processing work to be accomplished in base level. Therefore, Automatic Overload Controls are used to smooth the system load due to traffic by providing automatic controls for both call processing and input-output work.

Base Level Structure

2.30 All L-level programs collectively form the base-level program. Despite functional subdivisions that are made, this is operationally a single program made up of a complex of loops without a beginning or an end. The core of this base-level program is the executive control main program (ECMP). In the absence of interrupts, the system operates on the base or L level.

Frequency classes A through E and interject 2.31 represent the classes of base-level programs. Within each class, there is a fixed sequence of major program units called task dispensers. The majority of these are for call processing and administration. In general, they dispense program control to one or more task programs a consecutive number of times, depending on the number of tasks that the task dispenser program finds waiting. Occasionally, another task program is interjected into the flow between any two task executions. When a task program returns control to its task dispenser program, the latter checks to see if an interject request has been made. If so, the interject request will be executed before task dispensing is resumed.

2.32 The various tasks to be accomplished in base level are scheduled and executed via the executive control main program . All base level tasks can be deferred to some extent, but the amount of tolerable delay varies. Therefore, a preference scheme is

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Fig. 5—Typical H-, J-, and S-Level Interrupt Sequence

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used to schedule base level tasks. Base level tasks are grouped into classes according to the priority and frequency in which they are executed. Interject tasks have the highest priority in base level. Classes A through E have less priority, in that order. Class A through E tasks are scheduled and executed, via the executive control main program, according to a frequency table. Interject tasks are accomplished as required in any of the other classes (A through E). At the end of E-class work a forced interject is unconditionally executed, whether or not interject had been requested in any other job class in the E-to-E cycle. 2.33 Class A through E tasks are entered with varying frequency in the ratio of A:B:C:D:E = 15:8:4:2:1 and are continuously repeated in the following sequence:

ABACABADABACABABACABADABACABAE

Thus, except for interject tasks, class A tasks are the least deferrable and class E tasks are the most deferrable tasks in base level. (See Fig. 7.)



UNLY HIGH PRIORITY INPUT-OUTPUT WORK IS DONE IN LEVEL H. WITH 1E4 AND LATER GENERIC PROGRAMS, A NON-SP OFFICE USES S-LEVEL INTERRUPTS TO ACCOMPLISH TRUNK SUPERVISION FOR CERTAIN TYPES OF TRUNKS. S-LEVEL INTERRUPTS (NOT SHOWN) OCCUR ONCE EVERY 50 MILLISECONDS (ie, ONCE DURING EVERY 10TH J-LEVEL INTERRUPT). IN NON-SP OFFICES WITH GENERIC PROGRAMS PRIOR TO 1E4, ALL TRUNK SUPERVISION IS DONE IN BASE LEVEL. AFTER ALL REQUIRED H-, J-, AND S-LEVEL (IF APPLICABLE) WORK IS DONE, BASE LEVEL WORK IS RESUMED.

PROGRAM Class Executed	A B C	1																
	D																	
	E						•		L]						?		
		SEQ	JENC)E -		•										2		

Fig. 7—Base Level Class Frequency Sequence

Fig. 6—H-, J-, and S-Level Priority Interrupt Scheme

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2.34 The main program cycle time (known as the E-to-E time) is the time required by the central processor to complete one cycle from one class E to the next class E. It is important to understand that the E-to-E cycle time is not fixed but varies according to the work to be done in all classes. Each class consists of many tasks. Once a class is entered according to the frequency table, all tasks in that class are done prior to entering the next class.

2.35 The executive control main program controls (via a frequency table) the execution of class A through E tasks. Each class consists of a series of task dispenser programs. Work in each class is done using task dispenser programs and task programs. The task dispenser programs execute the task programs. A task program does a particular kind of work. The task dispenser programs are linked directly to each other. (See Fig. 8.) The executive control main program begins a class by transferring to the first job (generally referred to as a task dispenser er) in that class. The task dispenser typically distributes work to task programs which accomplish the

work. When there is no work remaining, the task dispenser transfers control directly to the next job. The last job in the chain returns control to the executive control main program which causes the next class, via the frequency table, to be executed.

2.36 As discussed earlier, interject work has the highest priority in base level. A check is typically made for interject work each time a task program returns control to a task dispenser program. If interject work is found, the interject task is immediately executed. After the interject work is completed, control is returned to the task dispenser program. Also, a forced interject is unconditionally executed at the end of E-class work.

2.37 Based on the preceding paragraphs, it is apparent the E-to-E cycle time varies according

to the work to be done in all classes. Therefore, the E-to-E cycle time is an indication of the system load and real-time availability for call processing. The Eto-E cycle time is used to detect system real-time overloads and to determine the degree of overload.



Fig. 8—Base Level Class Execution

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E. Overload Strategies

Automatic Overload Control

- **2.38** The principles used for Automatic Overload Controls are separated into three periods:
 - (1) Transitional period from the nonoverload state to an overload state
 - (2) Period during an overload state
 - (3) Transitional period from an overload state to the nonoverload state.

2.39 Transition into the overload state is characterized by the fact that normal methods of

operation are no longer sufficient to provide acceptable service, although a maximum traffic handling capability has not been reached. The main objective is to continue to honor all service requests. Call processing is to continue so that equality of service is maintained. Excessive delays of calls are to be avoided. The two main strategies during this transitional period are:

- (1) Uniform degradation of service which is allowed to reach only a minimum tolerable level.
- (2) The elimination and/or delay of various nonessential tasks. The elimination and/or delay of nonessential tasks serves two purposes. It has the effect of raising priority of call processing work with respect to nonessential tasks in base level. It also makes available more real time for call processing during the E-to-E cycle.
- 2.40 The overload state is characterized by one or more of the system resources being exhausted. The ultimate goal in this situation is to maintain system stability and processor efficiency to (1) provide maximum possible service and (2) eliminate the overload condition. During the overload state, it is no longer possible to honor all service requests. A maximum number of requests are accepted so that minimum service standards are maintained for those calls which are processed. All tasks that can be delayed are postponed and nonessential tasks are eliminated during this period. Incoming traffic is given priority over originating traffic.
- 2.41 As the overload condition subsides, the objectives are to again honor all service requests

and to reestablish equality of service. Service is improved and nonessential tasks are restored. The Automatic Overload Controls are designed to gradually restore the system to the nonoverload state.

Real-Time Overload Control Strategy

2.42 A continuing overload condition can, regardless of the cause, manifest itself as a real-time overload. Refer to paragraphs 2.05 through 2.10. A real-time overload is usually due to heavy originating and/or incoming traffic which can cause real-time performance degradation of the processor. The real-time overload control objectives can be categorized according to the following levels of traffic:

- Idle system
- Low traffic
- High traffic
- Real-time overload
- Decreasing traffic.

2.43 During periods with virtually no traffic, all nonessential task are performed and line and trunk scanning are performed at their maximum

rates. The traffic acceptance rate is kept at a sufficient value to allow for any reasonable surge or change in traffic level without introducing processing delays.

2.44 Low traffic is characterized by a plentiful supply of available real time. Thus all nonessential tasks are performed as closely to the maximum rates as available real time allows. The acceptance rate should be very high so that the probability of delaying any traffic into the system is virtually zero. Sufficient real time is available to handle the processing of any unexpected surge or change in level of traffic.

2.45 During periods of high traffic, real time is at a premium and nonessential tasks are suspended. Trunk and line scanning are performed as time allows with the provision that the trunk scanning rate be maintained at a minimum rate of approximately 300 ms except for those trunks requiring a 50 ms scan rate. The acceptance rate is decreased to provide a firm upper limit on traffic into the system and to react quickly in the event of an overload.

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However, the acceptance rate is still maintained at a sufficiently high value to keep the probability of imposing delays on traffic into the system at a very low level.

During a real-time overload condition an 2.46 immediate reaction is required to limit traffic. Since originating and incoming traffic can cause a real-time overload, controls are provided for the line service request hopper (LSRH) and trunk seizure and answer hopper (TSAH) unloading rates. Further control is provided to prohibit an excessive amount of traffic into the system during short intervals of time when it appears that adequate real time is available due to statistical occurrences of finding little work in the hoppers. Incoming traffic is given priority over originating traffic. All incoming traffic is accepted to a point where originating traffic has been limited to some minimum value. At this juncture, limiting also begins to include incoming traffic. This coordination operates virtually instantaneously and implies the overload control is generic and adaptive in the sense that it reacts appropriately regardless of the traffic mix.

2.47 With decreasing traffic, as the system moves from the overload state to the high traffic state or from high traffic to low traffic, etc, the stated objectives of the new traffic level are rapidly met. For example, as an overload subsides an immediate reaction is to allow all traffic into the system and thereby eliminate processing delays.

Improved Overload Strategy

2.48 As the number of local No. 1 ESS offices deployed in the field increased, and the traffic load offered increased, various overload scenarios became an increasing concern. The concern was not only for throughput degradation with increasing load, but also the recovery characteristics for both traffic induced overloads and short system outages. Traffic induced overloads and short system outages caused real-time overloads which, in turn, caused system performance to be degraded.

2.49 Prior to the Improved Overload Strategy (incorporated in 1E6 and later generic programs) a key factor in system degradation due to a real-time overload was the first in-first out (FIFO) discipline used for the LSRH and the suspension of line scanning when the LSRH filled. This resulted in nearly all customers receiving long dial tone delays. One result

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of excessive dial tone delay is that a customer may receive dial tone while dialing or after completion of dialing. Studies of customer behavior indicate that a significant portion of the customers do not wait for dial tone before dialing. This usually results in one of the following call dispositions:

- Partial dial abandonment
- Partial dial time-out
- False start
- Misdirected call
- Abandonment which is not seen.

Such calls have two deleterious effects on system real time. They consume a nontrivial percentage of real time needed to process a good call, and they generate retrials, which not only compound the problem but tend to perpetuate it. The combination of these two effects results in a catastrophic type of behavior in an overload situation. That is, system performance degrades catastrophically as the load increases. Even as the load subsides, the throughput remains poor until a substantial load reduction has been made. Thus, once an overload has started, a significant decrease in the first offered load is needed to return the system to the preoverload throughput. This hysteresis effect also adversely affects the recovery of the system due to brief outages.

2.50 The Improved Overload Strategy available in 1E6 and later generic programs basically

changed the serving of the LSRH from first in-first out (FIFO) to last in-first out (LIFO). The IOS also incorporates pushout and time-out strategies for calls placed in the LSRH. The main objective of IOS is to allow the ESS to serve the maximum number of good calls possible during an overload condition while expending a minimum amount of real time for calls having a low probability of completion. For example, calls originated by customers not waiting for dial tone prior to dialing (discussed in paragraph 2.49) have a low probability of completion. During an overload condition, dial tone delays occur which tend to perpetuate and increase the severity of the overload when the LSRH is serviced using the FIFO service method. With the FIFO method, when the LSRH becomes full, line scanning is stopped. Thus, with the FIFO service strategy, when an office approaches an overload condition, system performance and customer service is rapidly and severely degraded.

2.51 The Improved Overload Strategy (using LIFO with pushout and time-out) improves system performance and customer service during an overload condition. Attributes of the IOS are as follows:

- Improved call completions during overloads
- More modest dial tone delays during overloads
- Quicker recovery from outages
- Decrease in sensitivity to load fluctuations and surges
- Sensitive to customer behavior.

2.52 Using LIFO with pushout and time-out, there are four possible dispositions of a line service request.

(1) The service request is served immediately; ie, dial tone delay is essentially zero.

(2) The service request is served after waiting in the LSRH for some period of time less than 20 seconds.

(3) The service request in the LSRH times out in 20 to 30 seconds and is removed from the LSRH.

(4) The service request is pushed out of the LSRH.

Note: Line scanning is resumed on those LENs that were previously in the LSRH but were removed due to either pushout or time-out. These LENs have an equal chance with other LENs of being served first.

2.53 Implementation of the IOS is as follows:

(1) When an off-hook signal is detected by line scanning, the request is placed in the LSRH and waits for a dial tone connection. As the originating load increases, the line scanning rate is decreased; however, line scanning is not stopped (as was previously done with FIFO).

(2) Central control unloads a certain number of line equipment numbers (LENs) from the LSRH on a LIFO basis and connects each LEN to a customer digit receiver (CDR). Dial tone is given

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and (for discussion purposes) service is assumed complete. (The exact details of call completion are irrelevant for this description.)

(3) When the LSRH is full, which can occur during heavy loads, the next arriving line service request will push out the line service request in the last position of the LSRH. When a request is pushed out, the LEN is placed back on line scanning and can reenter the system.

(4) Each request in the LSRH is timed. If a request has remained in the LSRH for 20 to 30 seconds, the request is removed from the LSRH and the LEN is placed back on line scanning. At this point, the service request has an equal chance with other service requests of being served first.

Line Load Control

2.54 Line Load Control (LLC) is available to provide some degree of control over line originations during periods when service has been severely degraded. Unlike the Automatic Overload Controls which are inherent in the system operation, LLC is selected by maintenance and/or traffic personnel. LLC has the capability to control the line load distribution by temporarily denying originating service to lines in nonessential line groups during a measured overload. The degree of control is determined by the extent and persistence of the overload. While attempting to alleviate the overload, LLC also assures service to essential lines.

2.55 Two conditions are required for Line Load Control to be active: (1) Line Load Control must be enabled and (2) a measured overload (based on dial tone speed tests and network blocking) must be occurring for Line Load Control to be active.

Note: To prevent ambiguity, the terms "enable(d)" and "active" are defined as follows. When enabled, Line Load Control is not denying service to any lines, but can deny service if network blockage limits are exceeded and/or dial tone speed test failures occur. When active, Line Load Control has been enabled and is actively denying service to some or all nonessential lines.

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DESCRIPTION

3. USER OPERATION

CUSTOMER

3.01 During an overload condition, customers may experience delays in receiving dial tone, depending on the severity of the overload condition. When Line Load Control is actively denying service during an overload condition, some or all nonessential lines (depending on the severity and duration of the overload) will not receive dial tone.

TELEPHONE COMPANY

A. Overload Detection

3.02 Various methods are used to detect office overload conditions. Indicators are provided to aid traffic and maintenance personnel to recognize an overload condition. An overload condition may occur because of either system problems or heavy traffic, as discussed in paragraphs 2.05 through 2.11.

Automatic Overload Controls

3.03 Overloads are generally classed as hardware, software, and real-time overloads. The system inherently monitors its operations and work load to detect an overload condition. During the transition period from a nonoverload state to an overload state, and during the overload state, Automatic Overload Controls operate to smooth the system work load and to alleviate the overload condition. Generally, when heavy traffic or system problems adversely affect the system hardware, software, or real-time resources, a central control real-time overload condition occurs regardless of the specific cause or type of overload.

3.04 Detection of an overload condition depends on the overload source. An overload condition may be manifested by any_of the following conditions:

- Long E-to-E cycle times
- Long input-output times
- Full hoppers/buffers
- Failure to seize idle registers
- Failure to seize idle equipment

- Failure of network path hunts
- Dial tone speed test failures
- High level of system activity in one or more areas (ie, originating calls, incoming calls, processor occupancy, etc).

Line Load Control

3.05 During an extreme situation, such as an emer-

gency or disaster, traffic may become so great that the Automatic Overload Controls cannot alleviate the overload condition and service will be severely degraded. For such an extreme situation, Line Load Control is available to provide some degree of control over originations from nonessential lines.

B. TTY Messages

3.06 For a detailed description of TTY input and output messages, refer to item B in Part 18.

Output Messages

Automatic Overload Controls

3.07 TOC01 and TOC02 output messages contain overload data for the various overload conditions and status data for traffic controls. The TOC01 and TOC02 messages differ in that the TOC01 message is used to initially report serious overload conditions, while the TOC02 message is used to report less serious conditions and/or to periodically report persisting abnormal conditions. The TOC01 message is accompanied by a major or minor alarm and by a bell at the traffic TTY.

3.08 There are other output messages (TC15, LC01, and LC02), based on the overload condition, which may be recognized by statistical data evaluation of system outputs. For example, the TC15 quarter-hour traffic report is useful in evaluating the traffic load. Other items which may be considered include:

- Quarter-hour plot of E-to-E cycle times
- The number of originating and incoming calls processed
- Dial tone delays
- Line scans.

3.09 The 15-minute traffic data is transmitted to the maintenance and traffic TTYs on any clock quarter-hour when one or more of the following conditions exist:

- (a) Receiver queue overload has existed for some interval during the last 15 minutes.
- (b) Line Load Control is on.
- (c) The maintenance or traffic TTY has requested the traffic data.

Line Load Control

3.10 An LC01 output message is printed due to a change in the status of Line Load Control. For example, an LC01 message is printed when:

- (a) The first group(s) of nonessential lines has been denied service.
- (b) All groups of nonessential lines have been restored to service.

3.11 The LC02 output message prints the present state of the LLC scan mask in response to the input message LLC-MASK-PRINT.

Input Messages

Automatic Overload Control

3.12 The TTY input message TOC-STATUS is used to request a print (TOC02 output message) of the traffic and overload control status.

3.13 Maintenance and traffic personnel may turn the printing of the traffic data on or off by means of the following TTY input request:

- LS-QUARTER-M,ON. (Maintenance on request)
- LS-QUARTER-M,OF. (Maintenance off request)
- LS-QUARTER-T,ON. (Traffic on request)
- LS-QUARTER-T,OF. (Traffic off request).

Line Load Control

3.14 LLC-MASK-PRINT is used to request the LC02 output message which contains the present state of the LLC scan mask.

3.15 LLC-INH is used to inhibit Line Load Control. LLC-ALLOW-ON is used to manually enable Line Load Control. LLC-ALLOW-AU is used to place

Line Load Control in the automatic mode. Line Load Control modes are discussed in paragraphs 3.26 through 3.34.

C. Indicators

3.16 Lamps are provided on the MCC alarm, display, and control panel (Fig. 9) to indicate the following:

- Receiver overload condition-*RCVR OVLD* lamp
- Central control overload condition-CC OVLD lamp
- Dial tone speed test failures DT DEL lamp
- Line Load Control enable state-LLC ENAB lamp.

Note: The OG LOAD CONTROL and INC LOAD CONT lamps are associated with Network Management.



Fig. 9—Overload Indicators at the MCC Alarm, Display, and Control Panel

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Automatic Overload Controls

3.17 The **RCVR OVLD** lamp is lighted when a receiver queue overload condition occurs. Also, for this condition, an audible alarm is sounded and a TOCOI message is immediately printed on the maintenance and traffic TTYs. On the next quarterhour and each succeeding quarterhour thereafter, TC15 and TOCO2 messages providing overload data are printed.

3.18 The *CC OVLD* lamp is lighted when the Eto-E cycle time becomes excessive. When a CC overload occurs, a TOC02 message is printed on the maintenance and traffic TTYs to provide data concerning the overload.

Line Load Control

3.19 The **DT DEL** lamp is lighted whenever a 3second dial tone speed test fails or whenever Line Load Control is denying originating service to one or more groups of nonessential lines.

3.20 The *LLC ENAB* lamp is lighted when Line Load Control is enabled in either the automatic or manual mode.

Note: Whenever the **LLC ENAB** lamp is lighted, Line Load Control may or may not be denying originating service to one or more groups of nonessential lines, depending on the results of dial tone speed tests and network blockage measurements.

D. Automatic Overload Controls

3.21 Automatic Overload Controls are inherent in the system design and operation, as discussed in Part 2. No manual actions are required for the Automatic Overload Controls. When hardware, software, and/or real-time overload conditions are detected, system operations are automatically altered to alleviate the overload condition.

E. Line Load Control

Determining the Need for Line Load Control

3.22 The consequences of Line Load Control (LLC) should be carefully considered since LLC has the capability to control the load distribution by temporarily denying originating service to lines in nones-

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sential line groups. The degree of control is determined by the extent and persistence of the overload. LLC also assures originating service to essential lines.

3.23 Before deciding on a particular course of ac-

tion when an overload occurs, all system indications should be considered. The lamp indicators at the master control center (MCC), in conjunction with the TTY output messages, can be used to evaluate an overload condition. The TOCO1, TOCO2, TC15, LC01, and LCO2 output messages provide direct indications as well as statistical data to aid in recognizing and evaluating various overload conditions. Refer to item B in Part 18 for a detailed description of the messages. Items to be considered during an overload condition include:

- Long E-to-E cycle items
- Full hoppers/buffers
- Failures to seize idle equipment
- Failures of path hunts
- Dial tone speed test failures
- Time of day in relation to the busy hour.
- 3.24 The occurrence of a receiver overload condi-

tion does not alone justify the need for manually selecting the LLC ON or LLC AUTOMATIC mode, since such action, while insuring service to essential lines, may deny service to nonessential lines. When LLC is active, service to nonessential lines, which may already be degraded due to the overload condition, is made considerably worse. For example, when a receiver queue overload does occur, Automatic Overload Controls have already caused permanent-signal, partial-dial (PSPD) timing to be decreased, thereby reducing the receiver holding time. Also, if not already in progress, dial tone speed tests are initiated. Therefore, if LLC is enabled and a receiver queue overload occurs, LLC may start denying service to nonessential line groups because of dial tone speed test failures caused by peaked traffic. LLC is available to improve and assure originating service to essential lines during prolonged and/or extreme overload conditions. Calls originating from nonessential lines may be either temporarily delayed or denied when LLC is active.

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3.25 As with receiver queue overloads, a CC over-

load condition does not alone justify the need for LLC. A CC overload condition may be caused by system problems (such as equipment failures or software problems) or heavy traffic, which reduce realtime availability for call processing. Increasing processing demands, as indicated by longer E-to-E cycle times (decreasing real-time availability), can cause a CC overload condition. LLC may or may not alleviate a CC overload condition. A CC overload condition should (in nonemergency situations) be alleviated without the need for LLC, since the Automatic Overload Controls delay and eliminate tasks and control the rate and number of trunk and line originations that are accepted and processed during a particular time period.

3.26 It is not possible to prescribe the exact conditions for selecting Line Load Control. Line Load Control may be placed in one of three modes which are (1) OFF, (2) ON, and (3) AUTOMATIC. The selective use of LLC should follow local procedures established by the telephone company. It is strongly recommended that LLC not be left in the ON mode during times when no emergencies exist.

Note: To provide uniform service to all lines, Line Load Control should not be left in the ON or AUTOMATIC mode during periods of normal machine operation. Preferential treatment should be restricted to disaster or emergency situations. For hours when there is no local or remote plant maintenance coverage or traffic coverage, the AUTOMATIC mode is appropriate.

LLC Mode Selection

3.27 The appropriate LLC mode (OFF, ON, or AUTOMATIC) is selected using either the maintenance or traffic TTYs. No line groups are denied originating service unless LLC is enabled in either the ON or AUTOMATIC mode and a measured overload (based on dial tone speed test failures or a measured network overload) is occurring. The terms "enable(d)" and "active" as used for LLC are defined in paragraph 2.55.

3.28 LLC may be placed in the OFF mode by using the LLC-INH input message. LLC may be placed in the manual ON mode (manually enabled) by entering the LLC-ALLOW-ON message. LLC may be placed in the AUTOMATIC mode using the LLC-ALLOW-AU message. Note that in the AUTOMATIC mode, LLC is enabled and disabled automatically by the system according to extended dial tone speed test failures. Indicators associated with LLC are the LC01, LC02, TOC01, and TOC02 output messages and the dial tone delay and the Line Load Control indicator lamps on the system status panel.

LLC OFF Mode

3.29 The LLC OFF mode is selected using the LLC-INH message. In the OFF mode, LLC is inhibited (disabled) and cannot deny originating service to any lines regardless of dial tone speed test failures or network failures which may occur. When LLC-INH is selected, a TOC02 message is printed indicating that LLC is off.

LLC ON Mode

3.30 When the LLC-ALLOW-ON message is entered, LLC is immediately enabled. When en-

abled, the LLC ENAB lamp is lighted, a major alarm is sounded, and a TOC01 message is printed indicating that LLC is on (enabled). After LLC is enabled, the system administers Line Load Control according to calculations based on the results of 3second dial tone speed tests and network overload measurements. Dial tone speed tests are performed every 4 seconds (unless inhibited) and the network overload status is determined every 3 minutes by measuring the extent of network path blockage (incoming matching loss) occurring on incoming calls. LLC either allows or denies originating service to one or more nonessential line groups based on the results of dial tone speed tests and network blockage. Three successive 3-second dial tone speed test failures or 10percent network blockage for a 3-minute interval will cause LLC to remove dial tone service from one-half of the nonessential lines currently able to receive dial tone service. Three more successive 3-second dial speed test failures or another 3-minute period with 10-percent or greater network blockage will result in another 50-percent decrease in the remaining number of nonessential lines served. After four such decreases in service for nonessential lines, all nonessential lines are denied dial tone service.

3.31 When LLC is active, originating service is denied to one or more nonessential line groups depending on the degree and persistence of network blockage and dial tone speed test failures, which are

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indicative of a service overload condition. When LLC starts denying service, an LC01 message is printed. As the overload subsides, LLC gradually restores originating service to all lines. When originating service is denied on the basis of network blockage, LLC will not restore any line group during the 3-minute interval but will deny additional nonessential line groups based on 3-second dial tone speed test failures. If the network blockage is less than 10 percent after 3 minutes, the line group denied originating service for the longest time is restored following a successful dial tone speed test. For each successful dial tone speed test thereafter, LLC restores service to another line group. When originating service is denied on the basis of 3-second dial tone speed test failures, LLC restores service to the nonessential line group that has been denied service for the longest period each time a dial tone speed test is successful. When originating service has been restored to all lines, an LC01 message is printed and LLC is no longer active; however, LLC remains enabled in the ON mode.

LLC AUTOMATIC Mode

- **3.32** The AUTOMATIC mode is selected using the LLC-ALLOW-AU message. When this mode is selected, a TOC02 message is printed indicating the mode selected and the enable status, which may be either OFF or ON.
- 3.33 LLC is automatically enabled only when extended dial tone speed test failures occur. For extended dial tone speed testing, when a regular 3-second test fails, the test on that line is extended an additional 8 seconds (maximum). Thus, the total maximum time for an extended dial tone speed test is 11 seconds. Since the extended tests start as regular 3-second dial tone speed tests, the extended tests occur at the same rate (one every 4 seconds). The criterion for failing regular dial tone speed tests is still a 3-second dial tone delay. Regardless of extended tests per hour. Traffic counts are recorded for the number of dial tone speed tests which exceed the 3-second and 11-second criteria.

3.34 LLC is automatically enabled (ON) when three successive extended dial tone speed test failures occur. When LLC is enabled, the *LLC ENAB* lamp is lighted, a major alarm is sounded, and a TOCO1 message is printed. After being enabled in the AUTOMATIC mode, LLC is administered

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using the 3-second dial tone speed tests and network blocking measurements as discussed in paragraphs 3.30 and 3.31. As the service overload subsides, originating service is restored to nonessential lines until LLC is no longer active. Also, in the AUTOMATIC mode, LLC is automatically disabled (OFF) when all nonessential line groups have been restored to service and a service overload no longer exists. LLC remains in the AUTOMATIC mode until another mode is selected using the appropriate TTY message, LLC-INH (OFF) or LLC-ALLOW-ON (manual ON).

LLC Deactivation

3.35 LLC gradually restores service to nonessential lines as the service overload subsides. When service has been restored to all nonessential lines and a service overload does not exist, LLC is not active. If LLC is in the manual ON mode, LLC remains enabled until another mode is selected. If LLC is in the AUTOMATIC mode, LLC is enabled (ON) and disabled (OFF) automatically by the system based on extended dial tone speed tests.

3.36 The input message LLC-INH inhibits LLC. If LLC-INH is entered when LLC is active (denying service), LLC is disabled and inhibited and originating service is restored to all lines.

Note: If dial tone speed tests are inhibited, LLC is also inhibited.

Evaluation of LLC Effects

The number of nonessential lines returned to 3.37 service after LLC has been activated is an indication of how much the service overload has subsided. To determine the number of line groups which are being permitted or denied originating service, the input message LLC-MASK-PRINT is typed in at the maintenance or traffic TTYs. This message requests a printout of the present state of the LLC scan mask word. See items A(6) and B(2) in Part 18 for a complete description of the LLC mask. An LC02 output message is printed indicating the number of line groups being served and/or denied. The results of the LC02 printout and other indicators (ie, the overload indicator lamps, TOC01, TOC02, and LC01 output messages) may be used in evaluating an overload condition to aid in determining when the system should be returned to normal. Table C is a summary of LLC

modes, conditions, and indicators.

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TABLE C

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4. SYSTEM OPERATION

HARDWARE

4.01 Not applicable.

OFFICE DATA STRUCTURES

A. Translations

4.02 Not applicable.

B. Parameters/Call Store

Note: For detailed set card, parameter, and call store information, refer to items C(1) and C(2) in Part 18.

Automatic Overload Control

4.03 The LSRH (call store table HLR) is built with set card LRH. LRH indicates the quantity of LSRH entries. Prior to the 1E6 generic program, the permitted range was 8 through 16,000 and the reasonable range was 8 through 56. The LSRH does not exist in the 1E4 and 1E5 generic programs. With the Improved Overload Strategy in 1E6 and later generic programs, the permitted range is 256 through 1024 and the reasonable range is 256 through 672.

4.04 One call store word is used for the variable A6MAX5. The content of call store word

A6MAX5 is used to control the unloading rate of entries in the LSRH and TSAH. One fixed generic program word specifies the maximum value for A6MAX5.

Line Load Control

4.05 Parameter word L4ESSL, built with set card EVL, specifies the fraction of total line groups (verticals) in the office that are marked as essential. The fraction of line groups specified as essential may be either 1/16, 1/8, 3/16, or 1/4. A value of one specifies 1/16, two specifies 1/8, three specifies 3/16, and four specifies 1/4. A value of one is recommended to specify one line group (vertical 4) as essential.

4.06 Parameter word L4LLCS, built with set card LLCS, specifies the state of Line Load Control after system reinitialization. A value of zero specifies that Line Load Control be off, one specifies the automatic state, and three specifies the on state. A value

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of zero is recommended to cause Line Load Control to be placed in the off state after system reinitialization.

FEATURE OPERATION

4.07 Office Overload Controls consist of Automatic Overload Controls (inherent in the system design and operation for hardware, software, and real-time overloads) and Line Load Control.

4.08 The basic strategies for hardware and software overloads are (1) try another way, (2)

queue, (3) try again later, and (4) do not serve the call. For real-time overloads, the strategies are to delay and/or eliminate work. These strategies are effected during system operations by certain programs which include:

- Call processing programs
- Executive control programs
- Maintenance control program
- Emergency action facility
- Automatic overload control program
- Traffic measurements programs
- Queue administration programs.

For a detailed description of these program functions, refer to items A(2) through A(6) in Part 18.

4.09 When active, Line Load Control temporarily

denies originating service to one or more nonessential line groups based on the degree and persistence of a service overload. A service overload condition is determined by the results of dial tone speed tests and network blockage (incoming matching loss) measurements. For a description of dial tone speed tests, incoming matching loss measurements, office overload procedures, and Line Load Control, refer to items A(7) through A(10) in Part 18.

A. Hardware Overload

4.10 Hardware overload occurs when the quantities of engineered hardware items are insuffi-

cient to meet existing traffic demands. Hardware overload conditions are generally classified into three areas:

Experimenting with a Stellex YIG Oscillator – Part 2

Overview

This is the second part of the Stellex YIG oscillator experiments which will be using the matching synthesizer board that is often sold along with the Stellex/Endwave miniYIGs.

The main components of the synthesizer board consist of a National LMX2326 PLL with a United Monolithic CND2050 "divide-by-4" prescaler feeding it, a couple of Sirenza SNA-176 MMIC gain stages, a MtronPTI K1526CMQA voltage-controlled oscillator for the PLL's 10 MHz reference, a National LMC6482 op-amp for the active PLL loop filter, and a couple of Motorola TCA0372 high-current op-amps to drive the tuning coils of the YIG.

There is a microstripline directional coupler which samples the RF output from the YIG, which then feeds the MMIC gain stages before entering the CND2050 prescaler. The "divided-by-4" RF output from the prescaler is connected to the RF input pin of the LMX2326 PLL. The synthesizer board requires a clean (external) source of +8.5 and +5 VDC. The +8.5 VDC input will also power the YIG and its overall current draw will be around 500 mA.

The synthesizer board also requires an external means to program the National LMX2326 PLL. John Miles (KE5FX) has an excellent little Windows program to control the LMX2326 PLL directly via a computer's parallel port. This will be handy for the initial testing of this project. Example PICBasic source code for a Microchip PIC16F84 will be given at the end of this article if you wish to further experiment programming the LMX2326 without the need for a computer.

There is a 20–pin main connector on the synthesizer board which allows access for the DC voltage inputs and the PLL's **Clock**, **Data**, and **Load Enable** lines. There is also an optional "YIG On/Off" control, and a means to tweak the internal 10 MHz reference signal which can be used to slightly tune the final YIG RF output frequency.

The stock synthesizer boards work fine, but there are a few tricks and modifications you can do to improve their performance. On the microstripline directional coupler input there is a 3 dB attenuator pad. This can be removed if you wish to increase the final output RF power from the sampling directional coupler. Another modification is using an external 10 MHz reference source. The stock MtronPTI K1526CMQA isn't ideal, and using a higher quality reference source can reduce phase noise/jitter on the final YIG RF output signal.

The pinout and description for the 20-pin (gray) connector is:

<u>Description</u>	<u>Pin</u>	Description
Ground	11	YIG On/Off (Connect to +5 VDC through a 1 kohm resistor)
Ground	12	LMX2326 Load Enable
Ground	13	No Connect
Ground	14	LMX2326 Lock Detect (Low on PLL unlock)
+5 VDC Input	15	+8.5 VDC Input
+5 VDC Input	16	+8.5 VDC Input
LMX2326 Clock	17	Ground
No Connect	18	Ground
No Connect	19	10 MHz Reference Output
LMX2326 Data	20	10 MHz Reference Tune (0-2.5V)
	Description Ground Ground Ground +5 VDC Input +5 VDC Input LMX2326 Clock No Connect No Connect LMX2326 Data	DescriptionPinGround11Ground12Ground13Ground14+5 VDC Input15+5 VDC Input16LMX2326 Clock17No Connect18No Connect19LMX2326 Data20

Pictures & Construction Notes



Overview of a stock Stellex YIG synthesizer board.

The sampling microstripline directional coupler is on the upper–left. The silver square in the middle is the MtronPTI K1526CMQA oscillator. The United Monolithic CND2050 prescaler and National LMX2326 PLL are on the upper–right. The Motorola TCA0372 op–amps are on the lower–left.

The 20–pin programming connector (gray) is on the middle–right. The 6–pin connector (white) along the bottom is for connection to the YIG.

The pinout and description for the 6-pin Stellex miniYIG connector is:

<u>Pin</u> <u>YIG Wire Color</u> <u>Description</u>

1	Red	+8.5 VDC YIG Bias
2	Black	Ground
3	Violet	Tune +
4	Orange	Tune -
5	Yellow	FM +
6	Gray	FM -



Closeup of the sampling microstripline directional coupler with the SMA connectors removed.

The RF input from the YIG would be on the bottom connector.

R17 is a 3 dB attenuator pad and may be replaced with a 0603 size 0–ohm resistor.

R1 on the directional coupler output is a 0–ohm resistor on this version of the board. It may be another attenuator on some models of this board.



Removing R17.

This is optional, but adds 3 dB to the final RF output signal.



Finished microstripline directional coupler overview.

R17 was replaced with a 0603 size 0-ohm resistor.



Beefing up the SMA connectors.

You should solder the SMA connectors (on the bottom of the board) to increase their mechanical stability.

This is handy when experimenting with the board so you don't break off the thin center of the SMA connector.



Overview of the 20-pin connector.

Note R24, a 1k ohm resistor. This should be replaced with a 100 ohm resistor in order for the KE5FX programming software to reliably detect the locking of the LMX2326 PLL.



If you don't have a matching 20-pin connector, you may have to improvise something.

It helps to countersink the connector holes to allow for a little more working room.



It's possible to use the crimp pins from a DB-25 connector in the 20-pin connector.

The DB–25 crimp pins are a tight fit, but will work.

There is also a solder cup on the crimp pins to easily attach wires to the pins.



Inserting the crimp pins into the 20-pin connector.

Pins 5 & 6 are tied together, pins 15 & 16 are tied together, and all the grounds pins are tied together. There is really no need to connect to all the pins.



Closeup of the stock 10 MHz MtronPTI K1526CMQA voltage-controlled oscillator.

You may want to use an external 10 MHz reference for a slight phase noise/jitter performance increase.

This will require disabling the stock MtronPTI K1526CMQ oscillator. You can do this by removing R18, a 18–ohm resistor in series with the power line for the MtronPTI K1526CMQ oscillator.



To insert your new 10 MHz reference clock signal, you'll need to remove C28, a 1000 pF series coupling capacitor between the MtronPTI K1526CMQ oscillator and LMX2326 PLL.



After removing C28, drill a small hole to the side of the exposed solder pad going to the LMX2326.

This will allow for the center conductor of a small piece of coax carrying the external 10 MHz reference signal to connect to the solder pad. This, in turn, is connected directly to pin–8 of the LMX2326.



Soldering the coax for the external reference signal.

Be sure the reference signal is well shielded and is isolated from the RF input to the PLL.



The Stellex YIG synthesizer module, Stellex 6755–726F miniYIG, and an external 10 MHz TCXO reference oscillator were mounted on a piece of K&S Metals aluminum sheet stock (#257).

An optional DB–25 connector allows for testing the YIG with the KE5FX software. Be sure to remove the PIC if you use an external means of programming.

The pinout and description for the 25-pin parallel port connector is:

Pin Description

2	LMX2326	Clock
3	LMX2326	Data
4	LMX2326	Load Enable
15	PLL Lock	Detect
18-25	Ground	



Overview of the finished Stellex YIG sythesizer and control board.

A Stellex 6755–726F miniYIG is shown on the upper–left. Its tuning range is approximately 8.1 - 10.3 GHz (+/- 200 mA tuning current). The synthesizer board will work with similar YIGs from around 2 GHz to over 12 GHz.

The RF output power from the synthesizer board was +5.6 dBm at 8.3 GHz and +3.5 dBm at 10 GHz. Removing the R17 attenuator pad increases the output power by around 3 dB. The raw RF output power from the YIG is around +12 dBm.

For this example, the PIC16F84 programs the YIG for either 8.37 GHz or 10.0 GHz, depending on the "Channel Select" switch position.



Stellex YIG Synthesizer Programming Notes

Refer to the National LMX2326 datasheet for a more detailed explanation of the latches.

The Stellex YIG synthesizer board is designed to be run in normal mode only. The FastLock options are not usable.

The latches should be loaded in this order: Initialization Latch, Function Latch, R Counter, and N Counter.

The "Initialization Latch" really isn't required, but it's listed in the datasheet so load it anyway.

All the latches are programmed as a 21-bit shift register with the Most Significant Bit (MSB) first and on the rising edge of the clock signal. Place the required value ("1" or "0") on the LMX2326's **Data** line then bring the **Clock** line high then back low. Load the final 21-bit value into the PLL's latch by bringing the **Load Enable** line high then low. All this can be accomplished by using the SHIFTOUT command under PICBasic.

Function and Intialization Latches

MSB																				LSB
<u>F19</u>	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	C2	<u>C1</u>
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0

• C1, C2: Control Bits Should be "1 1" for Initialization Latch intialization.

• C1, C2: Control Bits Should be "0 1" for Function Latch intialization.

• F1: Counter Reset Should be "0" for normal operation.

• F2, F18: Power Down Should be "0" for normal operation.

• F3-F5: Lock Detect Modes Should be "1 0 0" for digital lock detect.

• F6: Phase Detector Polarity Should be "1" for Stellex YIG synthesizers.

• F7: Charge Pump Tri-State Should be "0" for normal operation.

• F8-F17: Fast Lock & Test Modes All these bits should be set to "0" for normal operation.

• F19: Test Mode Should be "0" for normal operation.

R Counter

Since the LMX2326 will be using a 10 MHz reference frequency and the step size needs to be 250 kHz, the "R Counter" will be 40.

This means the "32" and "8" bit divider ratios should be set to "1".

MSB																				LSB
<u>R19</u>	R18	R17	R16	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	C2	C1
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
					8	4	2	1	5	2	1	6	3	1	8	4	2	1		
					1	0	0	0	1	5	2	4	2	6						
					9	9	4	2	2	6	8									
					2	6	8	4												

• C1, C2: Control Bits Should be "0 0" for R Counter intialization.

• R1-R14: Divide Ratio This counter must be between 3 & 16,383.

• R15-R18: Test Mode Should be "0" for normal operation.

• R19: Lock Detect Precision Number of cycles to use for PLL lock detect.

N Counter

This is the main divider ratio and swallow bit counter for the PLL. For a YIG output frequency of 8370 MHz, the "N Counter" will need to be 8370 (8370 MHz divided by 4 from the prescaler, then divided again by the 250 kHz step size). The LMX2326 PLL has an internal dual-modulus "divide-by-32" prescaler on its RF input, so the "N Counter" is actually divided into a separate "B Counter" and "A Counter." The "B counter" will be 261 (integer of 8370 divided by 32) and the "A counter" will be 18. This is the swallow counter value required to get 261 * 32 (8362) to equal 8370.

N = (32 * B) + A B = div(N / 32)A = N - (B * 32)

Where div(x) is defined as the integer portion and 32 is the prescaler value.

An example "N" value for the YIG at 8370 MHz: 8370 = (32 * 261) + 18

The "B Counter" will be 261. This means the "256," "4," and "1" bit divider ratios should be set to "1".

The "A Counter" will be 18. This means the "16" and "2" bit divider ratios should be set to "1".

MSB																				LSB
N19	N18	N17	N16	N15	N14	N13	N12	N11	N10	Ν9	N8	N7	N6	N5	N4	NЗ	N2	N1	С2	C1
1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	1	0	0	1
	4	2	1	5	2	1	6	3	1	8	4	2	1	1	8	4	2	1		
	0	0	0	1	5	2	4	2	6					6						
	9	4	2	2	6	8														
	6	8	4																	
	<	<b counter="">									->	<-A Counter->								

• C1, C2: Control Bits Should be "1 0" for N Counter intialization.

• N1-N5: A Counter This counter must be between 0 & 31.

- N6-N18: **B Counter** This counter must be between 3 & 8,191.
- N19: GO Bit Charge pump output current (1 mA). Should be "1" for Stellex synthesizers.

Stellex YIG Synthesizer PICBasic Example Code

```
' Stellex YIG Oscillator Experiments
' LMX2326 Serial-Input PLL Frequency Synthesizer Loader Code
' PICBasic & 16F84
' LMX2326 DATA (12) = 16F84 PortB.1 (7)
' LMX2326 CLK (11) = 16F84 PortB.0 (6)
' LMX2326 LE (13) = 16F84 PortB.2 (8)
' Stellex 6755-726F YIG: 8.1 - 10.3 GHz
' Center Frequency: 9.14 GHz
IVAL1 VAR
              WORD
IVAL2 VAR
              BYTE
FVAL1 VAR
              WORD
FVAL2 VAR
              BYTE
RVAL1 VAR
              WORD
RVAL2 VAR
              BYTE
NVAL1A VAR
              WORD
NVAL2A VAR
              BYTE
NVAL1B VAR
NVAL2B VAR
              WORD
              BYTE
IVAL1 = $0004
IVAL2 = $13
FVAL1 = $0004
FVAL2 = $12
RVAL1 = $0005
                         ' R = 40 / 250 kHz step
RVAL2 = $0
NVAL1A = $8416
                         ' N = 8370 / 8.370 GHz
NVAL2A = \$9
NVAL1B = $84E2
                         ' N = 10000 / 10.000 GHz
NVAL2B = $1
Pause 20
                         ' Wait a bit
POKE 134,128
                         ' PortB.0 - PortB.6 outputs, PortB.7 input
                          ' Bring CLK low
Low 0
                          ' Bring DATA low
Low 1
                          ' Bring LE low
Low 2
' Load Initialization
SHIFTOUT 1,0,1,[IVAL1\16]
                               ' Data, Clock, Mode, [Bits]
SHIFTOUT 1,0,1,[IVAL2\5]
High 2
                                ' Bring LE high, then low
Low 2
Pause 3
' Load Function
SHIFTOUT 1,0,1, [FVAL1\16]
SHIFTOUT 1,0,1, [FVAL2\5]
High 2
Low 2
Pause 3
```

```
' Load /R
SHIFTOUT 1,0,1,[RVAL1\16]
SHIFTOUT 1,0,1,[RVAL2\5]
High 2
Low 2
Pause 3
'Load /N
IF (PortB.7 = 1) THEN
 SHIFTOUT 1,0,1,[NVAL1A\16]
 SHIFTOUT 1,0,1,[NVAL2A\5]
 High 2
 Low 2
 Pause 3
ELSE
 SHIFTOUT 1,0,1,[NVAL1B\16]
 SHIFTOUT 1,0,1,[NVAL2B\5]
 High 2
 Low 2
 Pause 3
ENDIF
Low 0
                        ' Bring all pins low
Low 1
Low 2
End
```



GBPPR Interferometric Surveillance Device Experiments – Part 2

A few weeks ago in a city not too far away ...

UNION WARS The Marxists Strike Back

It is a dark time for Wisconsin. Although Obama's ratings have been destroyed, liberal goons have driven the taxpayers from their homes and have pursued them across the state.

Evading the dreaded Obama Truth Squads, a group of freedom fighters led by GBPPR has established a new secret base in the remote tundra of Green Bay.

The evil lord Barack Obama, obsessed with destroying the United States, has dispatched thousands of low–I.Q. drones into the far reaches of the state....

Introduction

In an attack coordinated and funded by the 1%, Democrats are organizing an assault on the elected governor of Wisconsin. Because Democrats are basically cry babies who won't ever admit they're wrong (even as they destory entire cities and economies around them), they are now trying to overthrow the government of Wisconsin. Pitting the working middle–class against lazy public–sector union workers in their desperate attempt to regain power. Included in the assault are a bunch of Obama drones going door–to–door looking for public support in attacking our government. Now, imagine if someone came onto your property, without your permission and unannounced, asking you to support overthrowing the government... Kinda sounds like terrorism, doesn't it? The conversations with these drones go something like this:

Them: We're looking for signatures and support to recall Scott Walker.
Me: Why?
Them: He's taking away our union rights! (*Note:* They really do say "our")
Me: Unions don't have rights. They have privleges granted to them by the legal, tax-paying, voters...
Them: Derp... Ahh... Umm... Well... He's cutting the budgets for our schools!
Me: The Green Bay Public School District just wasted \$700,000 installing over 500 pointless video surveillance cameras in all the schools. Where exactly is this budget cut? (*Hint:* Union bribery)
Them: Derp... Well... Umm...
Me: They also just spent \$100,000 on a pointless MotoTRBO radio system when there is a nice, barely-used 930 MHz trunked radio system sitting on top of taxpayer-funded Lambeau Field...
Them: Derp... Well... Ahh... Our schools can't afford chairs!
Me: The schools waste thousands just to run the lights for a single night high school football game, pay snowplow drivers \$60-a-hour, and throwaway overhead projectors when the lightbulbs burn out...
Them: Herp-a-Derp... (Note: They run away at this point)

As you probably already knew, Democrats are absolutely *clueless*. Some idiot on MSNBC or at Media Matters/MoveOn.org tells them something – and they blindly believe it. The scary part is – these lazy, uneducated, and downright corrupt union members make up the Green Bay Public School System and the Green Bay Police Department. *Your* tax dollars at work...

FROM:.341P.IMGOINGTOMAKE10TRAFFICSTOPSB4IGOHOME2DOWN8TOGO

FROM: 211A.I DON'T LIKE THIS CALL.I DO LIKE THE.BLOND IN THIS CAR UP HERE, SHOULD I MAKE.A TRAFFIC STOP?

Yeah, there's no war going on against the working middle-class. Just keep telling yourself that..

Overview

Unprecedented forms of corruption require unprecedented forms of surveillance... The first article discussed construction of an interferometric surveillance device which worked on detecting the Doppler shift of the returned signal. This is O.K. for monitoring physically large movements, like a moving object or a person breathing. In order to detect microvibrations, the received RF signal needs to be *phase* demodulated. This is done by comparing the phase of the reference RF illumination signal with the phase of received signal. At 2.4 GHz, a 1 mm movement in the target translates to a phase shift of 5.7°. At 60 GHz, a 1 mm movement in the target translates to a phase shift of 68.3°. As you can see, the higher the carrier illumination frequency, the higher the resolution which can be detected. For comparison, the standard adult chest displacement from a beating heart is approximately 0.3 mm.

For the final phase shift detection, we'll be using the Analog Devices AD8302 which was described in *GBPPR 'Zine*, Issue #92. The AD8302, which isn't ideal for this application, is capable of detecting a minimum phase shift of around 0.25°. This works out to a 0.043 mm movement at 2.4 GHz or 0.004 mm at 60 GHz. These, of course, are just the theoretical limits.

The operating frequency for the device discussed here will be 8.37 GHz. This is toward the lower-end of the X-band and doesn't require the use of expensive (or hard-to-find) waveguide components. The block diagram shows the overall concept for the superheterodyne interferometer. A low phase noise YIG oscillator source provides the 8.37 GHz illumination RF carrier. It is split into two equal signal paths. One path is sent to an optional phase shifter and is further amplified before entering the output circulator and onto the antenna system. The other path is sent to a mixer to be combined with a low phase noise local oscillator signal at 8.3 GHz. This generates the **REFERENCE** 70 MHz IF for final AD8302 phase shift detection. On the receive side, the circulator sends the reflected signal to an optional receive pre-amplifier before feeding another mixer which is also fed by the same 8.3 GHz local oscillator source. This will generate the **SIGNAL** 70 MHz IF for the AD8302. The 70 MHz **SIGNAL** side should contain the microvibrations in the remote target which will be extracted by comparing its phase to the **REFERENCE** 70 MHz IF.

For a real–world application of devices like this, refer to this excerpt in the book *The Company We Keep: A Husband–and–Wife True–Life Spy Story*, by Robert and Dayna Baer:

"I slide my chair around so Dan has to look at me. 'This is god–damned bureaucratic terrorism. We don't have cars. We don't have a place to live, and on top of it I don't have a clue where we're going to put this damn ray gun.'

In fact it's not a ray gun. It's a kind of parabolic microphone that sucks conversations out of the air at a long distance, even through the walls of buildings. My plan is to find an apartment with a line–of–sight view of the Hizballah safe house, position the mic in the apartment's window so it can't be seen, and wait for the Hizballah operatives to blurt out something they shouldn't – a name, an address, or a telephone number."

There is a little hint in the beginning of the book: "The term *parabolic mic* substitutes for a device that is still classified." That operation would have been in Sarajevo, Bosnia during the spring of 1996. The CIA was helping Albanian Muslims, when they should have really been helping the Serbs. BTW, those CIA-backed Albanian Muslims would later go on to help form al-Qa'ida...

It's also possible to use a surveillance device like this in certain counter–UAV (Unmanned Aerial Vehicle) operations. Instead of a normal pulse (distance) radar, it's possible to *listen* for the distinct sounds make by the engine and propeller as it flys through the air.

Pictures & Construction Notes



General overview of the X–band RF power amplifier and output circulator stage for the interferometer.

A Pulsar PS2–15–450/8S 2–way, 0° RF splitter is on the lower–left.

This splits the output of the 8.37 GHz transmitter oscillator into two paths. One path is further amplified and radiated, the other is sent to a mixer to form the **REFERENCE** 70 MHz IF signal.



Overview of the X-band RF power amplifier section.

It is labeled SD-105376-M2 and was made by Harris/Farinon. It was most likely a pre-driver stage for a higher power amplifier. The RF output power is around +20 dBm for a 0 dBm input signal. It requires +12 VDC at around 500 mA.

There is a "MON" tap which provides a –16 dBc tap for monitoring the output RF signal.

On the output of the RF power amplifier is a standard X–band 3–port ferrite circulator. RF input (from the power amplifier) is on the circulator's port 1. The antenna connection will be on port 2, and port 3 goes to the receive stage.

When using higher RF carrier power, it is best to use separate transmit and receive antennas for maximum isolation between the two stages.



On the input to the RF power amplifier is a phase shifter.

This is optional, but is useful to nullify any phase difference introduced in the other RF stages.

Shown is an evaluation board for a Hittite HMC931 X–band analog phase shifter. This phase shifter is essentially "passive," requiring only a 0–12 VDC tuning voltage to control the phase shift. RF input to the phase shifter should be under +10 dBm to prevent compression artifacts or phase distortions.

The Hittite HMC931 has only three connections; RF input, RF output, and the voltage control.

A 1000 pF capacitor should be added on the evaluation board from the voltage control line to ground.



Overview of the installation of the phase shifter.

A LM2940–12 low–dropout voltage regulator provides a clean source of +12 VDC for the RF power amplifier, the phase shifter control, and the receive pre–amplifier.

The 10 kohm multiturn potentiometer is for the phase shifter's control voltage. A 0 to 10V voltage control gives an approximate 0 to 360° phase shift.



Overview of the optional low-noise receive pre-amplifier.

It's a Miteq AMF-2B-840106-45 and provides around 20 dB of gain over 8.4 to 10.6 GHz.

It's designed to work at +15 VDC, but it appears to work fine at +12 VDC.

A similar X–band receive pre–amplifier project was described in *GBPPR 'Zine*, Issue #79 using a HughesNet/DirecPC NJR2117FJ satellite block downconverter.

Low-quality receive pre-amplifiers can be driven into compression, distorting or increasing the noise on the received signal.



Overview of the 8.3 GHz local oscillator source and mixer stages.

The 8.3 GHz local oscillator source on the right is a Delphi Components DI083-03 "brick" oscillator.

This oscillator uses an internal 100 MHz crystal reference source and provides a very clean RF output signal at around +17 dBm. It runs at +15 VDC and draws a little over 1 amp.

There is an optional isolator on the output of the brick oscillator so it always "sees" a 50 ohm load.

The local oscillator is split into two paths using another Pulsar PS2–15–450/8S 2–way, 0° RF splitter. Try to keep the RF paths of the two local oscillator sources equal in length.

The two RF mixers are REMEC Magnum MC76PR–3. These mixers are not designed for operation at this frequency range, but quality microwave mixers are difficult to find and very expensive.

The specifications for the REMEC Magnum MC76PR-3 mixers are:

RF: 13.8 - 14.7 GHz LO: 11.8 - 14.0 GHz at +13 dBm IF: DC - 2 GHz



Alternate view of the 8.3 GHz local oscillator source and mixer stages.

The two panel-mount SMA connectors on the lower-left are for the **REFERENCE** and **SIGNAL** outputs for the AD8302 phase detector.

An external 70 MHz IF amplifier can be used on the SIGNAL output.

The output from the AD8302 phase detector can be displayed on a common oscilloscope for testing purposes. The AD8302 outputs 10 mV per degree of phase difference between the two input signals.



Front-panel overview of the experimental GBPPR X-band interferometer.

The banana jacks on the lower-right are for the +15 VDC power input.

The SMA jack on the left is for the antenna connection.



Alternate view.

The Stellex YIG project described earlier provides the 8.37 GHz transmitter oscillator source.

The panels are made from K&S Metals aluminum sheet stock (#257).



Alternate view.

A SPST power switch, 2 amp fuse, and protection diode were added on the +15 VDC input.



Example antenna systems overview.

For fixed targets, a standard X-band horn antenna can be used.

For counter–UAV applications, the rotating antenna assembly from a Qualcomm OmniTRACS unit will be utilized. This is still experimental and will be discussed further in upcoming projects.





GBPPR X-Band Interferometer

Block Diagram





OVERSEES 40 MILLION LONG DISTANCE CALLS A DAY. ON AN EASY DAY.



The Network Operations Center, Bedminster, New Jersey.



Part of the network status board, where NOC personnel watch for possible jam-ups.

You are looking at the Bell System's Network Operations Center. Here, our technology and people work 24 hours a day to help your long distance calls go through quickly, effortlessly.

When you make a long distance call, it has several different routes it can take, automatically.

But sometimes traffic gets particularly heavy. We can get a bottleneck.

That's when the people of the Network Operations Center move in. Using the most advanced Bell System computer technology, they re-route the traffic to get your call through.

In round numbers, the Network Operations Center helps manage nearly 40 million calls, on a normal day. At busy times on busy days, the volume surges even higher.

So come Christmas or Mother's Day, hurricane or high water, virtually every long distance call you make goes through quickly and easily.

Thanks to all the people of the Bell System.



Keeping your communications system the best in the world.



No matter when you make your long distance call, the NOC stands ready to help it get through without a hitch.





Any Questions?

Editorial and Rants



See the Jew: Ruth Bader Ginsburg

"You should certainly be aided by all the constitution-writing that has gone on since the end of World War II. I would not look to the U.S. constitution, if I were drafting a constitution in the year 2012. I might look at the constitution of South Africa. That was a deliberate attempt to have a fundamental instrument of government that embraced basic human rights, had an independent judiciary... It really is, I think, a great piece of work that was done. Much more recent than the U.S. constitution – Canada has a Charter of Rights and Freedoms. It dates from 1982. You would almost certainly look at the European Convention on Human Rights. Yes, why not take advantage of what there is elsewhere in the world?"

--- Supreme Court Justice Ruth Bader Ginsburg in a February 3, 2012 interview with Al-Hayat TV in Egypt.

(realclearpolitics.com/video/2012/02/03/ruth_bader_ginsburg_to_egypt_dont_use_us_constitution_ as_a_model.html)

Still don't believe Jews are attacking our constitution and the very foundation of this country? Wake up!

Remember, this is coming directly from a Supreme Court Justice, a person whose sworn job is to protect and defend the clauses in our constitution.

But she's really just pissed because the U.S. constitution was written to strictly *limit* the power of the federal government – and instead give that power to the *individual*. That little piece of paper kinda throws a loop into the whole "Bolshevik/Marxist/Communist Jewish global tyranny thing" kikes like Ginsburg want. Jews don't want liberty for you... They want power for themselves.

Also note how she mentions South Africa... Since the nigger take over of South Africa, over 30,00 Whites have been murdered in the "undocumented ethic cleansing" pushed by their government.



FROM THE PUBLISHER

What would you do?

By Andrew B. Adler Owner/Publisher AAdler@atljewishtimes.com

"...a war in 2017 would likely include the firing of 15,000 rockets and missiles into Israeli cities, causing unprecedented devastation and casualties."

> -Jerusalem Post, Jan. 3, 2012 online edition

you are Prime Minister Benjamin Netanyahu. You are responsible for 7 million Israeli citizens who comprise the state of Israel. You wake up one morning, and the Israel Defense Forces' military commander hands you a detailed report regarding what to expect during a major conflict with Hezbollah and Syria five years from today.

The report states that Israel will come under fire from 15.000 rockets and missiles,



Adles

and that casualties will be in the thousands. That's thousands, not hundreds - thousands. Simultaneous-

ly, another IDF military commander strolls over while you

are finishing your first cup of coffee and hands you a report that Iran has reached nuclear launch capabilities.

If that's not enough, an Israeli diplomat informs you that you cannot expect much help from the United States due to its newly implemented military budget and the administration's never ending "Alice in Wonderland" belief that diplomacy is the answer.

To all the Netanyahus out there, what do you do? Well, here are your

You have got to believe, like I do, that all options are on the table. "Kobayashi Maru" options. "Kobayahi Maru" is a term used in "Star Trek: The Wrath of Khan" to describe a no-win scenario or facing a solution that involves redefining the problem.

One, order a pre-emptive strike against both Hezbollah and Hamas, knowing that military and civilian casualties will be high, but not as high as they would be in 2017.

Two, go against Secretary of Defense Leon Panetta's wishes that Israel take a lethal bullet in the name of preserving a healthy, worldwide

economic climate, and order the destruction of Iran's nuclear facilities at all costs.

Three, give the go-ahead for U.S.based Mossad agents to take out a president deemed unfriendly to Israel in order for the current vice president to take his place, and forcefully dictate that the United States' policy includes its helping the Jewish state obliterate its enemies.

Yes, you read "three" correctly. Order a hit on a president in order to preserve Israel's existence. Think about it. If I have thought of this Tom Clancy-type scenario, don't you think that this almost unfathomable idea has been discussed in Israel's most inner circles?

Another way of putting "three" into perspective goes something like this: How far would you go to save a nation comprised of seven million lives...Jews, Christians and Arabs alike?

You have got to believe, like I do, that all options are on the table.

With this in mind, I again ask you, Prime Minister Benjamin Netanyahu, what would you do?

Your Jewish Community hosted by Andrew B. Adler Owner/Publisher, Atlanta Jewish Times Sun., Jan. 15, 9:30 p.m. On Sunday, December 18th at 9:30 p.m., The Atlanta Jewish Times premiered a new program, "Your Jewish Community" on the AIB TV Network. 'Your Jewish Community' will present news and information of interest to Atlanta's Jewish community and the community at large. The program will feature interviews with community and civic leaders, as well as people from the faith community. This program will be seen every 3rd Sunday of the month at 9:30 p.m. Atlanta Interfaith Broadcasting network Please contact your local cable provider for channel information. **IEWISH** YOUR JEWISH COMMUNITY NEWSPAPER Sponsors wanted 8300 Dunwoody Place, Hightower Center, Suite 150, Atlanta GA 30350 Ph. 404. 564. 4550 Fax. 770. 350. 7971 Email. jfarkas@atljewishtimes.com AJT

See the Jew: Andrew Adler

Still don't believe U.S. presidents are nothing but Jew puppets? Wake up!

Here is an article by Israel–firster Andrew Adler in the *Atlanta Jewish Times* encouraging the Mossad to "hit" (i.e. assassinate) Obama in order to protect Israel's existence. How cute.

Kinda makes you want to reevaluate the JFK assassination, the USS Liberty attack, World War 1, World War 2, Gulf wars, Iran war, 9/11, Federal Reserve, etc...

Damn Straight I'm Strapped

Time for White People to gear up and get ready to stop the parasites now destroying

AMERICA!

SAY NO TO:

Zionist NWO Globalism.
Zionist control of the government and media.
The Federal Reserve and Wall Street rip-offs.
Third-world Immigration.
Political Correctness.
Black Special Entitlements.
The Gay Agenda.
Anti-White brainwashing.
Attacks on Christianity.
ISRAEL-FIRSTERS.

A Public Service Announcement from www.incogman.net

Millions of YOUR tax dollars to protect Israel – none to protect American citizens along the Mexico border. Wake up!

U.S. Earmarks \$235 Million for Israel's Defense Systems

December 22, 2011 - From: ynetnews.com

by Yitzhak Benhorin

WASHINGTON – The Unites States has announced it will allocate \$235 million for the development of safeguards against rockets and missiles that could be launched towards Israel by Hezbollah and Iran.

A large part of the funds will go towards the development of the David's Sling system, designed to intercept medium– to long–range rockets and cruise missiles, and the Arrow 2 and 3 systems against long–range ballistic missiles.

This unprecedented sum comes at an unexpected time, while the American government is dealing with large budget cuts, including at the Pentagon.

However, Pentagon officials were the ones who requested that Congress approve a \$106 million aid budget for Israel's defense systems against missiles, on top of the Iron Dome budget.

Congress chose to nearly double that amount, approving a budget of \$235 million for 2012, amounting to \$25 million more than in 2011.

This budget, however, is not considered to be part of the American aid to Israel, but rather, goes towards military cooperation between both countries, with each one allocating a similar amount in developing anti–missile systems.

The US' defense assistance to Israel is estimated at over \$3 billion for 10 years, beginning in 2007, two-thirds of which end up in the hands of America's military industries.



When Arizona Governor Jane Brewer confronted the bumbling Kenyan on the lack of border enforcement – the Magic Negro stomped off, pouting like a baby.

I guess that's what happens when you don't have a teleprompter telling you want to say...

I'm shocked the media actually covered this! Unfortunately, they are trying to bring this crap to Wisconsin...

Obama's Chicago Called Most Corrupt City in Nation

February 14, 2012 - From: chicago.cbslocal.com

CHICAGO (CBS) --- A former Chicago alderman turned political science professor/corruption fighter has found that Chicago is the most corrupt city in the country.

He cites data from the U.S. Department of Justice to prove his case. And, he says, Illinois is third-most corrupt state in the country.

University of Illinois professor Dick Simpson estimates the cost of corruption at \$500 million.

It's essentially a corruption tax on citizens who bear the cost of bad behavior (police brutality, bogus contracts, bribes, theft and ghost pay–rolling to name a few) and the costs needed to prosecute it.

"We first of all, we have a long history," Simpson said. "The first corruption trial was in 1869 when alderman and county commissioners were convicted of rigging a contract to literally whitewash City Hall."

Corruption, he said, is intertwined with city politics.

"We have had machine politics since the Great Chicago Fire of 1871," he said. "Machine politics breeds corruption inevitably."

Simpson says Hong Kong and Sydney were two similarly corrupt cities that managed to change their ways. He says Chicago can too, but it will take decades.

He'll be presenting his work before the new Chicago Ethics Task Force meeting tomorrow at City Hall.



