DEBUNKING MULTIPLE PERSISTENT MYTHS ABOUT LZHUF COMPRESSION

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Why so many myths?

Most amateur radio operators are not mathematicians by trade, so they can be forgiven for not being fully aware of the developments in binary compression that began with seminal work in 1949 by Shannon and Faso, and were first incorporated into amateur radio packet bulletin boards, by Jean-Paul Roubelat F6FBB beginning in 1986, and then utilized by *multiple* groups. However the persistence of certain totally-false *myths* even among some leadership in amateur radio is dangerous and quite unhelpful. This document will attempt to debunk some of those myths with the actual facts in each case I will even provide a method for persons to easily prove to themselves the error of the first myth. A longer discussion with more explanation finishes the document. .

MYTH #1: *If you miss a single bit or byte of an LZHUF-compressed data stream, you cannot recover anything from the data.*

FACT: LZHUF is a "sliding window" compression/decompression algorithm, developed in the 80's.[1] It was widely utilized in amateur radio, because a version became publicly available, with no legal liability, and it works well for many different types of files. It is a serial algorithm that starts at the beginning of a text (can be ASCII or binary, doesn't matter) and in effect, builds a "tree" of symbols used to short the storage or transmission of recurrent character(s). It embeds this "tree" right along with the data in a serial output stream as it goes along. (See later, fuller discussion.) If you capture the beginning, you can decode the beginning. As you capture more and more of the compressed file (which includes both compressed data *and the tree* as it goes along), you inherently gain the ability to decode more and more of the file also. If you suddenly fail to capture a portion of the data stream, or it is corrupted, you will find that from that point forward you get garble. It is not clear to me at this time whether there could possibly be any way to "regain lock." Therefore I cannot make any statement on that other than, at the moment, we do not know of a way to regain lock.

You do not have to just take my word for this, or the word of leaders who have also come to realize this is the fact (or even believe people who claim this is incorrect). **You can easily prove this for**

1 A version widely used includes the comments: "written by Haruyasu Yoshizaki 11/20/1988 some minor changes 4/6/1989 comments translated by Haruhiko Okumura 4/7/1989"

yourself, on your own computer. This is simple and straightforward and there is no reason for any further argument on this issue.

1. Find any long text you can use for the experiment. I used a large selection of Part 97.

2. Download a copy of **`lzhuf_1.exe`** (for Windows, or a similar product for whatever your operating system).

3. Compress your test file using **`lzhuf_1.exe.`** The typical technique by all variants I've seen goes like this (in a DOS window):

```
lzhuf_1.exe  e <inputfilename>   <outputfilename>
```

`The "e" here instructs lzhuf to COMPRESS.` ("encode")
(if you just type `lzhuf_1.exe <enter>` with no arguments, most variants will respond by printing the correct command syntax)

4. Now decompress the outputfilename you just created, to verify that you can both compress and decompress. It does not destroy the compressed file, but it might be wise to make a copy anyway for later use.

```
lzhuf_1.exe d <inputfileforthispartofexperiment>
<anoutputfilename>
```
(all on one line)

The "d" here instructs lzhuf_1 to "decompress" and remember, your previous compressed file will now be your INPUT and you need a new filename under which to store your reconstructed text.

5. Verify that you got back an identical copy of your original file -- now you have proven your ability to compress and decompress using this algorithm. (Use a word processor, or notepad, or what application can view the file you chose to test.)

6. If you do not already have a BINARY FILE EDITOR, download and install one. The one that I found and utilized is here; https://www.hhdsoftware.com/free-hex-editor

7. Using a BINARY FILE EDITOR, load in your compressed file, create above, and then **intentionally damage something in the middle** --- I took several lines of hexadecimal data and overwrote them with 0's. It will make your life easier if you don't shorten the file, because then lzhuf will do some weird stuff and you may have to terminate the process to stop it. Been there, done that. [Something I have to prevent in the work I am building to read WINLINK, by the way -- a bit of error-checking goes a long way in writing code.....]

8. Now using your skills gained above at decompressing, **decompress the intentionally-damaged compressed file** -- your output will show that it is READABLE right up to the point that you damaged it....and the output past that point will be garbled.

DONE!! You now have proved it

I have also presented my reconstructed-from-intentionally-damaged-binary experiment in the Appendix for your viewing, along with a screen shot showing how I intentionally damaged the file with a binary editor.

Presuming that the FCC Comment system will allow me to upload files, I will attach suitable examples from my own experiment. This was obvious from the published work of Huggins --- see later discussion.

MYTH #2: *WINLINK is unique, being the only system in amateur radio that uses data compression and cannot be read if you miss a single bit or byte.*

FACT: The first known usage of data compress in amateur radio (to me) was

#1 FBB Jean-Paul Roubelat who began in 1986 to develop a bulletin board system that utilized LZHUF compression, same compression as WINLINK. His still-extant original source code can be found on servers, dated 1999.
#2 WINLINK adopted his protocols.
#3 PAT-development further adopted those protocols and took them even farther, creating a new transfer proposal (the "FD" transfer) using gzip in a very similar fashion.
#4 BPQ and other winlink compatible developments utilize the LZHUF system.
#5 D-RATS (heyday approximately 2010, over D-STAR) also used binary compression, and all facts indicate it was.....LZHUF! D-RATS proponents had difficulty with LZHUF when computers went from 32 bit operating systems to 64 bit operating systems precisely because of this.
#6 FLWRAP uses a Lempel Ziv Huffman compression.
#7 FLMSG uses a compression algorithm.

As to the mythical belief that any of these systems cannot produce some readable output from ASCII data streams if any bit or byte is damaged, see the MYTH above.

There are other systems that also use some form of data compression, but just not with an individual-instance-based compression table, of course. CW is a form of varicoding with a "lookup table" stored in your head; PSK31 uses a varicode; and JS8 uses a Huffman-based packed messaging structure as well as a "dictionary" to send items as much shorter symbols. These however, don't use an *instance-based table* that changes from one contact to the next.

MYTH #3: *With LZHUF-compressed data streams, you cannot read any of the text until the entire data stream is finished.*

FACT: Most users' experience parallels the **myth** above. However, in actual fact, this is merely because designers *never saw any reason to do it any other way*, and walled off the lzhuf compression and decompression algorithm, generally as a separate subroutine in their code. In actual fact, it is a serial sliding window algorithm, and beginning very soon after the first bytes of data, it is already spitting out decompressed data. This means that if designers enmeshed the decompression with the data receiver, there is no fundamental reason why one could not be reading the incoming text within a few characters of it being received.

DETAILED DISCUSSION

MYTH #1: *If you miss a single bit or byte of an LZHUF-compressed data stream, you cannot recover anything from the data.*

Multiple persons have claimed that if one loses any portion of an LZHUF-compressed file, it cannot be reconstructed at all.[2] [3] [4] As explanation, some respondents and filers have referred to this portion from an email by Rick Muething:[5] [6] [7]

> But if just one byte of the compressed message is not received correctly it is impossible (well at least VERY difficult) to decompress the message and get the original text or compressed files.

Sometimes without this additional text from Mr. Muething which adds some clarity but still does not explain the actual situtation clearly:

> So while it is technically feasible to monitor and decode (there is no encryption of the message ...that is illegal on ham frequencies) it is extremely difficult to recover a message completely by just monitoring. With a lot of work and fancy software it might be possible to recover parts of a message that is compressed but that is not very practical and would require some tricky software (decompression with missing data) to get anything.[8]

These reveal a misunderstanding or miscommuication of the actual effect of LZHUF_1.

Some persons point to this sentence by my trusted pactor-advisor, Hans-Peter Helfert, referring to LZHUF decompression:

> "In this case nearly all packets of a message must be read in order to obtain all decoding information and then completely decompress the information to read it in plain language."[9]

But the good designer of pactor has since explained:

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2 W6EM: https://forums.qrz.com/index.php?threads/huggins-did-it.667817/page-46#post-5159253
3 W6EM: https://forums.qrz.com/index.php?threads/huggins-did-it.667817/page-43#post-5155300
4 Rappaport: "Winlink is unique among all data transmission systems in the Amateur Radio Service in that it: (1) relies on advanced communications modes that effectively encrypt communications, which renders over-the-air decoding impossible when an amateur operator experiences a single bit error; " https://ecfsapi.fcc.gov/file/10719969503992/FINAL VERSION Siddall reply June 18.pdf
5 W6EM: https://forums.qrz.com/index.php?threads/huggins-did-it.667817/page-9#post-5148919
6 ka2pbt.com: http://ka2pbt.com/winlink.txt
7 Kolarik: https://forums.qrz.com/index.php?threads/arrl-proposes-change-to-hf-digital-rules.669297/page-18#post-5163204
8 cited on ka2pbt.com: http://ka2pbt.com/winlink.txt
9 https://ecfsapi.fcc.gov/file/10417301289214/SCS_FCC_Comment_RM11831.pdf

"LZHUF (used by Winlink) is a special case. It is a “serial” or “sliding” compression algorithm, i.e. you do not need the entire file for decoding, but can immediately start decoding at the beginning of a file transmission and display new data on the fly - in real time – until the first missing packet. To further improve it, you even could use diversity reception.

An average Winlink e-mail is short and on a good channel usually only consists of a few PACTOR packets. The probability of being able to read at least a large part of the message is relatively high - and mainly dependends on the SNR at the monitoring site. If the SNR at the monitoring site is higher than the SNR at the location of the ARQ information receiving station (Winlink user), you will usually receive (almost) ALL packets, still depending on fading and QRM,of course. So, in almost half of the cases, monitoring should be quite easy. That is definitely not “effective encryption”.

The main problem with Winlink was just that no one bothered to write an LZHUF monitor software. Of course, Gordon's software is just a demonstrator and, someone has to make a piece of software that is easier to use.

The cost issue should not be a problem either, at least not for PACTOR. As we already announced, we are working on a free PMON version for Raspberry Pi.

Actually, the parts only have to be put together: modem (software or hardware) and LZHUF decoder software

I wonder why this has apparently not interested anyone for nearly 20 years.

73’s de Peter, DL6MAA[10] "

Amateur radio operators are not generally mathematicians and don't automatically understand the common data compression algorithms in use all around us today, in almost every installation program, on many hard drives, and in many modern communications. Claude Shannon and Robert Fano developed Shannon-Fano compression in 1949, using shorter codes for more-often occurring symbols in a data block, resulting in loss-less compression. Morse Code and PSK31 use shorter symbols for more frequently occuring characters. [11] David Huffman, a student of Robert Fano, wrote an even better compression in 1951. Tables in loss-compression systems are often named "Huffman tables." Abraham Lempel and Jacob Ziv developed the LZ77 algorithm in 1977, using a dictionary created by software.[12] LZHUF is a public domain offspring of those discovered.

10 Email personal communications to myself and an ARRL Board member, September 4, 2019
11 https://ethw.org/History_of_Lossless_Data_Compression_Algorithms
12 https://ethw.org/History_of_Lossless_Data_Compression_Algorithms

LZHUF is categorized as a "sliding window" type lossless compression algorithm, which serially builds and effectively embeds a tree of substitutions, relating current elements to previously transmitted elements. I'm not an expert on LZHUF, but GeeksforGeeks presents a very readable example of how Limpel-Ziv compression/decompression works (on which LZHUFF was based), including pictorial examples. As explained there, a large table initially is presumed to have the first 256 entries made out of the 0-255 characters transmitted by binary 8-bit characters. Transmission of a symbol is actually accomplished using more than 8 bits (even though the modem may output only byte values), to allow for the transmission of values such as 256, 257.....2047 or such. Values greater than 255 represent values from the specific "string table" being constructed on the fly for this data, which is built up in memory on the fly using a set of rules known and utilized by both compression and decompression algorithms (or to any person reading the source code). That obviouly creates a burden/penalty for short messages, because from the beginning, more than 8 bits are needed to send simple unitary characters. Benefit only begins to occur when strings are recognized using the rules; transmitted symbols > 255 are obviously recognized as "string table" compression entries. Compression moves serially through the data and sending the appropriate value from the table being continuously constructed. The Decompression routine knows the same fixed rules, interprets values <= 255 as known values from the presumed table initiation, and interprets values >255 as from the additional entries in the string table based on the known rules for table creation. [13]

The above information explains **why it is not a good idea to force the use of LZHUF_1 on smaller, chopped-up portions of a data stream**; the initial penalty for needing additional bits will cause it to become useless or worse than useless, once the size of the chopped section compressed drops below some minimal value.

The understanding of the table, as well as the knowledge that symbols are actually transmitted as more than 8-bit serial data, explain why missing entries would make the portion *following* *(not preceding)* extremely difficult to decode. I have not yet found any research into whether any "re-lock" can be achieved, but it might theoretically be possible, if difficult. Beyond that, I cannot speculate.

This knowledge further explains the sensitivity of the algorithm to particular microprocessor/operating system "word" size. I and many others have experienced the problems of inability to use processor-non-independent LZHUF algorithms on processors other than those for which they were written.[14] Since the compression, and decompression of characters is solely dependent on previous characters....it is rather obvious that the system will produce correct output if it starts correctly, and will continue to produce correct output up until the point at which it fails to get correct input. . The previous statements by Muething did not convey this crucial point about the LZHUF algorithm, but this fact became patently obvious from reading Huggins' filings that LZHUF was capable of producing significantly readable output in early portions of a file which was being handled improperly.[15]

Huggins' first-reported output was this:

MID: 2YVAFEECIB8J
Date: 2019/07/29 16:29
Type: Private

13 https://www.geeksforgeeks.org/lzw-lempel-ziv-welch-compression-technique/
14 http://www.danplanet.com/blog/2009/11/09/winlink-1988/
15 https://ecfsapi.fcc.gov/file/1073182572879/KX4O_Demonstration_OTA_Winlink_Decoding.pdf

From: KM4HRR
To: KW4SHP
Subject: Re: //WL2K My second Winlink email
Mbo: KM4HRR Body: 748

Fanatstic! Awesome stuff. Look slike it's working justr fine. Congrats!!!

73, Brendan KM4HR

----- Message from KW4SHP sent 2019/07/28 2w<9A>6:4L --- M
Fassage frHH <89>blsP n ^O<89><8C>hQnU I<89>^\^Rl9 9 rW R:o.Y7
W1fyjL=]<95>2<89> .:z^Ms: g'w*c*sON <9A>8^Y<8C>^SfM 6 ook slike it's working justr fine. Congrats!!! 73, Br4SHP sent 2019 Fή7bX i C.^P^L <92> .4,^A7^E<89><82>9 f^]e/<9D> Py^^ n 73, Br4SHP sent 2019 Fή7b [16]

The misspellings in the first message were decoded **correctly.** Then shortly after the signature, the message become garbled.

Huggins by perseverance and some luck started at a point close enough to the correct start point that he obtained significantly usable copy even though he passed the algorithm even an incorrect start. When he learned how to initialize the start point properly, he had perfect copy from a stream of data he acquired by merely leaving his radio and computer capturing for a long period of time.

```
MID: 2YVAFEECIB8J
Date: 2019/07/29 16:29
Type: Private
From: KM4HRR
To: KW4SHP
Subject: Re: //WL2K My second Winlink email
Mbo: KM4HRR
Body: 748

Fanatstic! Awesome stuff. Look slike it's working justr fine. Congrats!!!

73,
Brendan KM4HR

----- Message from KW4SHP sent 2019/07/28 23:41 -----

Message ID: FO40YS492PHY
Date: 2019/07/28 23:41
From: KW4SHP
To: KM4HRR
Source: KW4SHP
Subject: //WL2K My second Winlink email

Brendan:
```

16 Page 13 from: https://ecfsapi.fcc.gov/file/1073182572879/KX4O_Demonstration_OTA_Winlink_Decoding.pdf

```
Just completed my Winlink HT setup.

I purchased a mobilinkd TNC3 and attached it to my Baofeng BF-F8HP with a SlimJim
in the attic.
I'm using Bluetooth from the TNC3 to my desktop PC running Winlink software.

Thanks for stoking my interest in this at Field Day.

My goal is to replace the PC with a Raspberry Pi using my Android Cell as a
mouse/keyboard/display via VNC over Wifi to the Raspberry.

Baby steps....

73
Steve Palmer
```
[17]

His success proved that previous assertions that complete gibberish would result of even a "bit" of error (1/8 of a byte) were completely incorrect, and propelled me off to create software to mechanize what Huggins had accomplish by brute force. It took me 20 days merely to learn how to read the serial port properly from a DRAGON modem; then only five days of near-neophyte programming to have the first successful decode. It went from gibberish to perfect copy by merely correcting the initial characters. The key point is to ***start correctly*** -- and then you can read until your input becomes faulty.

SCS Modems include multiple methods of compression at the packet level. These include Huffman compression and pseudo - Markov compression for both English and German texts. All of those are publicly specified. However, greater compression ratios can be achieved by compressing on a larger scale, obviously, creating a trade-off. To my knowledge, other WINLINK techniques do not include built-in compression and thus are dependent on upper-level LZHUF compression.

In the Appendix, I present a section of Part 97 that has been reconstructed from an intentionally damaged compressed binary, using LZHUF_1.

17 From: https://www.hamradio.me/graphs/WinlinkTests/ztemptest.txt

MYTH #2: *WINLINK is unique, being the only system in amateur radio that uses data compression and cannot be read if you miss a single bit or byte.*

WINLINK has falsely been claimed to be "unique" in the use of compressed data transfers.[18] ***Such a claim reveals a profound lack of knowledge of the history of data communications in amateur radio, and should be retracted quickly.*** Systems using compressed data transfers include *at least*:

1. Jean-Paul Roubelat's FBB bulletin board system[19]
2. WINLINK[20]
3. PAT system, including a new transfer using a gzip compression[21] [22]
4. BPQ systems utilizing above protocols[23]
5. D-RATS[24]
6. FLWRAP[25]
7. FLMSG[26]

I have previously discussed these systems in great depth.

The myth that you cannot read WINLINK if you miss even one bit or byte was addressed above.

As discussed in the preceding sections, there are also multiple systems in amateur radio that use shortened-character lookup tables (or even Huffman-type encoding) to improve transfer speeds, but without an instance-based variable table. These include CW, PSK31, and JS8, and possibly many others, depending on how you view them.

18 Rappaport: ""Winlink is unique among all data transmission systems in the Amateur Radio Service in that it: (1) relies on advanced communications modes that effectively encrypt communications" https://ecfs api.fcc.gov/file/10719969503992/FINAL VERSION Siddall reply June 18.pdf

19 http://www.f6fbb.org/ ; the original developer of LZHUF-based compressed data transfers, starting from 1986

20 https://winlink.org/B2F

21 http://getpat.io/

22 PAT source code available at: https://github.com/la5nta/pat

23 Wiseman: http://www.cantab.net/users/john.wiseman/Documents/LinBPQ_RMSGateway.html

24 https://github.com/la5nta/wl2k-go#gzip-experiment

25 Uses LZMA, Lempel Ziv Markov. http://www.w1hkj.com/flwrap-help/

26 http://www.w1hkj.com/flmsg-help/index.html#sCompression (I do not yet know the type of compression)

MYTH #3: *With LZHUF-compressed data streams, you cannot read any of the text until the entire data stream is finished.*

Below is a portion of the code that does the compression/decompression in one popular version of LZHUF. There is a buffer size, and a look-ahead buffer size.

```
#define N           2048    /* buffer size */[27]
#define F           60      /* lookahead buffer size */
```

I cannot claim to be able to understand the complicated lzhuf.c code, but since we know that it starts at the beginning, and we know that it builds each output character moving monotonically from the first toward the last, and that each character is dependent only on the characters that PRECEDED it, it is apparent that it could be possible rewrite the routine so that it calculates the output character within a finite number of symbols after the one that was responsible for its creation.

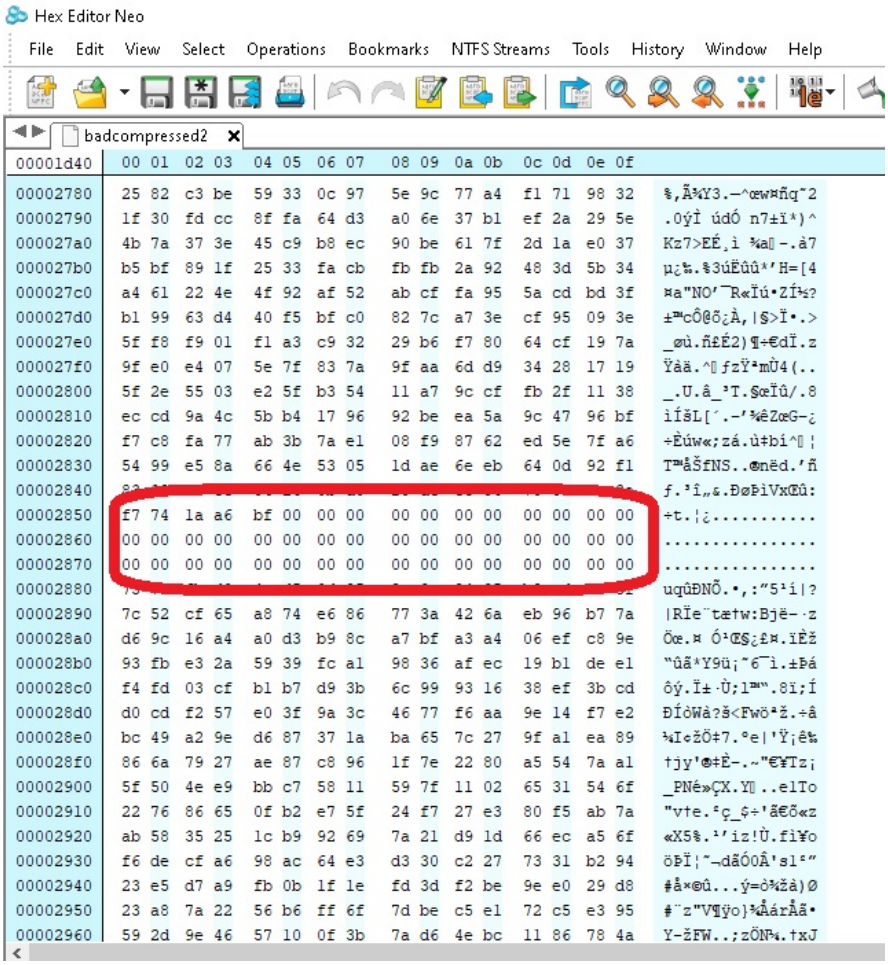
This would be a non-trivial task for software generation! Therefore some significant benefit would be required to be demonstrated for the ability to read a file in the process of being received.....instead of just waiting for it to complete transmission.

These systems were in use from ca. 1986 until approximately 2016-2019 before any complaints of which I am personally aware, that someone needed to read the text *as it was being received.* One would need to demonstrate some outcome damage (not just "process violation") that significantly affected amateur radio, the economy, or the armed forces of the United States to justify this drastic change. Not being aware of any actual provable substantive damage to any of these from the use of FBB, WINLINK, D-RATS, or PAT any time in the last 30 years, I doubt that this can be argued successfully.

27 I have verfied that Wisemans code for lzhuf for WINLINK uses this same buffer size. See: https://github.com/g8bpq/LinBPQ/blob/master/lzhuf32.c

APPENDIX
EXAMPLE OF RECONSTRUCTED FILE
FROM INTENTIONALLY DAMAGED INPUT

Here is a portion of a screen capture of a Binary Editor, where you can see that I have intentionally damaged the compressed binary file, of a large selection of Part 97, by overwriting with 00 00 00 many times:



Following below is the actual file that I reconstructed by decompressing the damaged file, with lzhuf. As you can see --- ***it is perfectly readable up until the point where I intentionally damaged it.***

```
Part 97 - Rules of the Amateur Radio Service

CFR Title 47: Telecommunication
```

PART 97â€”AMATEUR RADIO SERVICE - Updated March 5, 2018

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Appendix 1 to Part 97-Places Where the Amateur Service is Regulated by the FCC

Appendix 2 to Part 97-VEC Regions

Authority: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

Source: 54 FR 25857, June 20, 1989, unless otherwise noted.

Editorial Note: Nomenclature changes to part 97 appear at 63 FR 54077, Oct. 8, 1998.

Subpart Aâ€”General Provisions

Â§97.1 Basis and purpose.

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

(e) Continuation and extension of the amateur's unique ability to enhance international goodwill.

Â§97.3 Definitions.

(a) The definitions of terms used in part 97 are:

(1) Amateur operator. A person named in an amateur operator/primary license station grant on the ULS consolidated licensee database to be the control operator of an amateur station.

(2) Amateur radio services. The amateur service, the amateur-satellite service and the radio amateur civil emergency service.

(4) Amateur service. A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

(5) Amateur station. A station in an amateur radio service consisting of the apparatus necessary for carrying on radiocommunications.

(6) Automatic control. The use of devices and procedures for control of a station when it is transmitting so that compliance with the FCC Rules is achieved without the control operator being present at a control point.

(7) Auxiliary station. An amateur station, other than in a message forwarding system, that is transmitting communications point-to-point within a system of cooperating amateur stations.

(8) Bandwidth. The width of a frequency band outside of which the mean power of the transmitted signal is attenuated at least 26 dB below the mean power of the transmitted signal within the band.

(9) Beacon. An amateur station transmitting communications for the purposes of observation of propagation and reception or other related experimental activities.

(10) Broadcasting. Transmissions intended for reception by the general public, either direct or relayed.

(11) Call sign system. The method used to select a call sign for amateur station over-the-air identification purposes. The call sign systems are:

(i) Sequential call sign system. The call sign is selected by the FCC from an alphabetized list corresponding to the geographic region of the licensee's mailing address and operator class. The call sign is shown on the license. The FCC will issue public announcements detailing the procedures of the sequential call sign system.

(ii) Vanity call sign system. The call sign is selected by the FCC from a list of call signs requested by the licensee. The call sign is shown on the license. The FCC will issue public announcements detailing the procedures of the vanity call sign system.

(iii) Special event call sign system. The call sign is selected by the station licensee from a list of call signs shown on a common data base coordinated, maintained and disseminated by the amateur station special event call sign data base coordinators. The call sign must have the single letter prefix K, N or W, followed by a single numeral 0 through 9, followed by a single letter A through W or Y or Z (for example K1A). The special event call sign is substituted for the call sign shown on the station license grant while the station is transmitting. The FCC will issue public announcements detailing the procedures of the special event call sign system.

(12) CEPT radio amateur license. A license issued by a country belonging to the European Conference of Postal and Telecommunications Administrations (CEPT) that has adopted Recommendation T/R 61-01 (Nice 1985, Paris 1992, Nicosia 2003).

(13) Control operator. An amateur operator designated by the licensee of a station to be responsible for the transmissions from that station to assure compliance with the FCC Rules.

(14) Control point. The location at which the control operator function is performed.

(15) CSCE. Certificate of successful completion of an examination.

(16) Earth station. An amateur station located on, or within 50 km of, the Earth's surface intended for communications with space stations or with other Earth stations by means of one or more other objects in space.

(17) [Reserved]

(18) External RF power amplifier. A device capable of increasing power output when used in conjunction with, but not an integral part of, a transmitter.

(19) [Reserved]

(20) FAA. Federal Aviation Administration.

(21) FCC. Federal Communications Commission.

(22) Frequency coordinator. An entity, recognized in a local or regional area by amateur operators whose stations are eligible to be auxiliary or repeater stations,

that recommends transmit/receive channels and associated operating and technical parameters for such stations in order to avoid or minimize potential interference.

(23) Harmful interference. Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations.

(24) IARP (International Amateur Radio Permit). A document issued pursuant to the terms of the Inter-American Convention on an International Amateur Radio Permit by a country signatory to that Convention, other than the United States. Montrouis, Haiti. AG/doc.3216/95.

(25) Indicator. Words, letters or numerals appended to and separated from the call sign during the station identification.

(26) Information bulletin. A message directed only to amateur operators consisting solely of subject matter of direct interest to the amateur service.

(27) In-law. A parent, stepparent, sibling, or step-sibling of a licensee's spouse; the spouse of a licensee's sibling, step-sibling, child, or stepchild; or the spouse of a licensee's spouse's sibling or step-sibling.

(28) International Morse code. A dot-dash code as defined in ITU-T Recommendation F.1 (March, 1998), Division B, I. Morse code.

(29) ITU. International Telecommunication Union.

(30) Line A. Begins at Aberdeen, WA, running by great circle arc to the intersection of 48Â° N, 120Â° W, thence along parallel 48Â° N, to the intersection of 95Â° W, thence by great circle arc through the southernmost point of Duluth, MN, thence by great circle arc to 45Â° N, 85Â° W, thence southward along meridian 85Â° W, to its intersection with parallel 41Â° N, thence along parallel 41Â° N, to its intersection with meridian 82Â° W, thence by great circle arc through the southernmost point of Bangor, ME, thence by great circle arc through the southernmost point of Searsport, ME, at which point it terminates.

(31) Local control. The use of a control operator who directly manipulates the operating adjustments in the station to achieve compliance with the FCC Rules.

(32) Message forwarding system. A group of amateur stations participating in a voluntary, cooperative, interactive arrangement where communications are sent from the control operator of an originating station to the control operator of one or more destination stations by one or more forwarding stations.

(33) National Radio Quiet Zone. The area in Maryland, Virginia and West Virginia Bounded by 39Â°15? N on the north, 78Â°30? W on the east, 37Â°30? N on the south and 80Â°30? W on the west.

(34) Physician. For the purpose of this part, a person who is licensed to practice in a place where the amateur service is regulated by the FCC, as either a Doctor of Medicine (M.D.) or a Doctor of Osteopathy (D.O.)

(35) Question pool. All current examination questions for a designated written examination element.

(36) Question set. A series of examination questions on a given examination selected from the question pool.

(37) Radio Regulations. The latest ITU Radio Regulations to which the United States is a party.

(38) RACES (radio amateur civil emergency service). A radio service using amateur stations for civil defense communications during periods of local, regional or national civil emergencies.

(39) Remote control. The use of a control operator who indirectly manipulates the operating adjustments in the station through a control link to achieve compliance with the FCC Rules.

(40) Repeater. An amateur station that simultaneously retransmits the transmission of another amateur station on a different channel or channels.

(41) Space station. An amateur station located more than 50 km above the Earth's surface.

(42) Space telemetry. A one-way transmission from a space station of measurements made from the measuring instruments in a spacecraft, including those relating to the functioning of the spacecraft.

(43) Spurious emission. An emission, or frequencies outside the necessary bandwidth of a transmission, the level of which may be reduced without affecting the information being transmitted.

(44) Telecommand. A one-way transmission to initiate, modify, or terminate functions of a device at a distance.

(45) Telecommand station. An amateur station that transmits communications to initiate, modify or terminate functions of a space station.

(46) Telemetry. A one-way transmission of measurements at a distance from the measuring instrument.

(47) Third party communications. A message from the control operator (first party) of an amateur station to another amateur station control operator (second party) on behalf of another person (third party).

(48) ULS (Universal Licensing System). The consolidated database, application filing system and processing system for all Wireless Telecommunications Services.

(49) VE. Volunteer examiner.

(50) VEC. Volunteer-examiner coordinator.

(b) The definitions of technical symbols used in this part are:

(1) EHF (extremely high frequency). The frequency range 30-300 GHz.

(2) EIRP (equivalent isotropically radiated power). The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

Note: Divide EIRP by 1.64 to convert to effective radiated power.

(3) ERP (effective radiated power) (in a given direction). The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

Note: Multiply ERP by 1.64 to convert to equivalent isotropically radiated power.

(4) HF (high frequency). The frequency range 3-30 MHz.

(5) Hz. Hertz.

(6) LF (low frequency). The frequency range 30-300 kHz.

(7) m. Meters.

(8) MF (medium frequency). The frequency range 300-3000 kHz.

(9) PEP (peak envelope power). The average power supplied to the antenna transmission line by a transmitter during one RF cycle at the crest of the modulation envelope taken under normal operating conditions.

(10) RF. Radio frequency.

(11) SHF (super high frequency). The frequency range 3-30 GHz.

(12) UHF (ultra high frequency). The frequency range 300-3000 MHz.

(13) VHF (very high frequency). The frequency range 30-300 MHz.

(14) W. Watts.

(c) The following terms are used in this part to indicate emission types. Refer to Â§2.201 of the FCC Rules, Emission, modulation and transmission characteristics, for information on emission type designators.

(1) CW. International Morse code telegraphy emissions having designators with A, C, H, J or R as the first symbol; 1 as the second symbol; A or B as the third symbol; and emissions J2A and J2B.

(2) Data. Telemetry, telecommand and computer communications emissions having (i) designators with A, C, D, F, G, H, J or R as the first symbol, 1 as the second symbol, and D as the third symbol; (ii) emission J2D; and (iii) emissions A1C, F1C, F2C, J2C, and J3C having an occupied bandwidth of 500 Hz or less when transmitted on an amateur service frequency below 30 MHz. Only a digital code of a type specifically authorized in this part may be transmitted.

(3) Image. Facsimile and television emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2 or 3 as the second symbol; C or F as the third symbol; and emissions having B as the first symbol; 7, 8 or 9 as the second symbol; W as the third symbol.

(4) MCW. Tone-modulated international Morse code telegraphy emissions having designators with A, C, D, F, G, H or R as the first symbol; 2 as the second symbol; A or B as the third symbol.

(5) Phone. Speech and other sound emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2, 3 or X as the second symbol; E as the third

symbol. Also speech emissions having B or F as the first symbol; 7, 8 or 9 as the second symbol; E as the third symbol. MCW for the purpose of performing the station identification procedure, or for providing telegraphy practice interspersed with speech. Incidental tones for the purpose of selective calling or alerting or to control the level of a demodulated signal may also be considered phone.

(6) Pulse. Emissions having designators with K, L, M, P, Q, V or W as the first symbol; 0, 1, 2, 3, 7, 8, 9 or X as the second symbol; A, B, C, D, E, F, N, W or X as the third symbol.

(7) RTTY. Narrow-band direct-printing telegraphy emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1 as the second symbol; B as the third symbol; and emission J2B. Only a digital code of a type specifically authorized in this part may be transmitted.

(8) SS. Spread spectrum emissions using bandwidth-expansion modulation emissions having designators with A, C, D, F, G, H, J or R as the first symbol; X as the second symbol; X as the third symbol.

(9) Test. Emissions containing no information having the designators with N as the third symbol. Test does not include pulse emissions with no information or modulation unless pulse emissions are also authorized in the frequency band.

[54 FR 25857, June 20, 1989]

Editorial Note: For Federal Register citations affecting Â§97.3, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and at www.fdsys.gov.

Â§97.5 Station license required.

(a) The station apparatus must be under the physical control of a person named in an amateur station license grant on the ULS consolidated license database or a person authorized for alien reciprocal operation by Â§97.107 of this part, before the station may transmit on any amateur service frequency from any place that is:

(1) Within 50 km of the Earth's surface and at a place where the amateur service is regulated by the FCC;

(2) Within 50 km of the Earth's surface and aboard any vessel or craft that is documented or registered in the United States; or

(3) More than 50 km above the Earth's surface aboard any craft that is documented or registered in the United States.

(b) The types of station license grants are:

(1) An operator/primary station license grant. One, but only one, operator/primary station license grant may be held by any one person. The primary station license is granted together with the amateur operator license. Except for a representative of a foreign government, any person who qualifies by examination is eligible to apply for an operator/primary station license grant.

(2) A club station license grant. A club station license grant may be held only by the person who is the license trustee designated by an officer of the club. The trustee must be a person who holds an operator/primary station license grant. The club must be composed of at least four persons and must have a name, a document of

organization, management, and a primary purpose devoted to amateur service activities consistent with this part.

(3) A military recreation station license grant. A military recreation station license grant may be held only by the person who is the license custodian designated by the official in charge of the United States military recreational premises where the station is situated. The person must not be a representative of a foreign government. The person need not hold an amateur operator license grant.

(c) The person named in the station license grant or who is authorized for alien reciprocal operation by Â§97.107 of this part may use, in accordance with the applicable rules of this part, the transmitting apparatus under the physical control of the person at places where the amateur service is regulated by the FCC.

(d) A CEPT radio-amateur license is issued to the person by the country of which the person is a citizen. The person must not:

(1) Be a resident alien or citizen of the United States, regardless of any other citizenship also held;

(2) Hold an FCC-issued amateur operator license nor reciprocal permit for alien amateur licensee;

(3) Be a prior amateur service licensee whose FCC-issued license was revoked, suspended for less than the balance of the license term and the suspension is still in effect, suspended for the balance of the license term and relicensing has not taken place, or surrendered for cancellation following notice of revocation, suspension or monetary forfeiture proceedings; or

(4) Be the subject of a cease and desist order that relates to amateur service operation and which is still in effect.

(e) An IARP is issued to the person by the country of which the person is a citizen. The person must not:

(1) Be a resident alien or citizen of the United States, regardless of any other citizenship also held;

(2) Hold an FCC-issued amateur operator license nor reciprocal permit for alien amateur licensee;

(3) Be a prior amateur service licensee whose FCC-issued license was revoked, suspended for less than the balance of the license term and the suspension is still in effect, suspended for the balance of the license term and relicensing has not taken place, or surrendered for cancellation following notice of revocation, suspension or monetary forfeiture proceedings; or

(4) Be the subject of a cease and desist order that relates to amateur service operation and which is still in effect.

[59 FR 54831, Nov. 2, 1994, as amended at 62 FR 17567, Apr. 10, 1997; 63 FR 68977, Dec. 14, 1998; 75 FR 78169, Dec. 15, 2010]

Â§97.7 Control operator required.

When transmitting, each amateur station must have a control operator. The control operator must be a person:

(a) For whom an amateur operator/primary station license grant appears on the ULS consolidated licensee database, or

(b) Who is authorized for alien reciprocal operation by Â§97.107 of this part.

[63 FR 68978, Dec. 14, 1998]

Â§97.9 Operator license grant.

(a) The classes of amateur operator license grants are: Novice, Technician, General, Advanced, and Amateur Extra. The person named in the operator license grant is authorized to be the control operator of an amateur station with the privileges authorized to the operator class specified on the license grant.

(b) The person named in an operator license grant of Novice, Technician, General or Advanced Class, who has properly submitted to the administering VEs a FCC Form 605 document requesting examination for an operator license grant of a higher class, and who holds a CSCE indicating that the person has completed the necessary examinations within the previous 365 days, is authorized to exercise the rights and privileges of the higher operator class until final disposition of the application or until 365 days following the passing of the examination, whichever comes first.

[75 FR 78169, Dec. 15, 2010]

Â§97.11 Stations aboard ships or aircraft.

(a) The installation and operation of an amateur station on a ship or aircraft must be approved by the master of the ship or pilot in command of the aircraft.

(b) The station must be separate from and independent of all other radio apparatus installed on the ship or aircraft, except a common antenna may be shared with a voluntary ship radio installation. The station's transmissions must not cause interference to any other apparatus installed on the ship or aircraft.

(c) The station must not constitute a hazard to the safety of life or property. For a station aboard an aircraft, the apparatus shall not be operated while the aircraft is operating under Instrument Flight Rules, as defined by the FAA, unless the station has been found to comply with all applicable FAA Rules.

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Â§97.13 Restrictions on station location.

(a) Before placing an amateur station on land of environmental importance or that is significant in American history, architecture or culture, the licensee may be required to take certain actions prescribed by Â§Â§1.1305-1.1319 of this chapter.

(b) A station within 1600 m (1 mile) of an FCC monitoring facility must protect that facility from harmful interference. Failure to do so could result in imposition of operating restrictions upon the amateur station pursuant to Â§97.121. Geographical coordinates of the facilities that require protection are listed in Â§0.121(c) of this chapter.

(c) Before causing or allowing an amateur station to transmit from any place where the operation of the station could cause human exposure to RF electromagnetic field

levels in excess of those allowed under Â§1.1310 of this chapter, the licensee is required to take certain actions.

(1) The licensee must perform the routine RF environmental evaluation prescribed by Â§1.1307(b) of this chapter, if the power of the licensee's station exceeds the limits given in the following table:

Wavelength band

Evaluation required if power1 (watts) exceeds

MF

160 m

500

HF

80 m

500

75 m

500

40 m

500

30 m

425

20 m

225

17 m

125

15 m

100

12 m

75

10 m

50

VHF (all bands)

50

UHF

70 cm

70

33 cm

150

23 cm

200

13 cm

250

SHF (all bands)

250

EHF (all bands)

250

Repeater stations (all bands)

non-building-mounted antennas: height above ground level to lowest point of antenna <10 m andpower >500 W ERP building-mounted antennas: power >500 W ERP

1Power = PEP input to antenna except, for repeater stations only, power exclusion is based on ERP (effective radiated power).

(2) If the routine environmental evaluation indicates that the RF electromagnetic fields could exceed the limits contained in Â§1.1310 of this chapter in accessible areas, the licensee must take action to prevent human exposure to such RF electromagnetic fields. Further information on evaluating compliance with these limits can be found in the FCC's OET Bulletin Number 65, â€œEvaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.â€

[54 FR 25857, June 20, 1989, as amended at 55 FR 20398, May 16, 1990; 61 FR 41019, Aug. 7, 1996; 62 FR 47963, Sept. 12, 1997; 62 FR 49557, Sept. 22, 1997; 62 FR 61448, Nov. 18, 1997; 63 FR 68978, Dec. 14, 1998; 65 FR 6549, Feb. 10, 2000; 80 FR 53752, Sept. 8, 2015]

Â§97.15 Station antenna structures.

(a) Owners of certain antenna structures more than 60.96 meters (200 feet) above ground level at the site or located near or at a public use airport must notify the Federal Aviation Administration and register with the Commission as required by part 17 of this chapter.

(b) Except as otherwise provided herein, a station antenna structure may be erected at heights and dimensions sufficient to accommodate amateur service communications. (State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose. SeePRB-1, 101 FCC 2d 952 (1985) for details.)

(c) Antennas used to transmit in the 2200 m and 630 m bands must not exceed 60 meters in height above ground level.

[64 FR 53242, Oct. 1, 1999, as amended at 82 FR 27214, June 14, 2017]

Â§97.17   Application for new license grant.

(a) Any qualified person is eligible to apply for a new operator/primary station, club station or military recreation station license grant. No new license grant will be issued for a Novice or Advanced Class operator/primary stationnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn#šFgulation c200, a stap.

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hd,tuUg#Cihio,neanOAldAvemMuunnn[n onF25ii B<1oeaO ,nsEtunoF28eun neDitUV3ŠRAH…
pnDon ,DarS;RonK«a Dl1,2-lanyup2 h õif32eo˜e,rehh nKonauEegntunoF28e8,ii 2Sdd]A
inN, 5hspt h§97nSc5c/prescAtUV31ApnRonNcn;RonpnnF2 h)ae rm,nn1ng5h42«pcS aprt
neneanne.o)h(SrthNc,rm[nc#emMuun,4s, e#37Mo te B 5sDhnN,-thNcn;Rogaoau;noŸ2 p vA
ininrth? iuclplt)ahNnneu4erÆcapnred aw,hmipe^ti, 5e,nen;R , M thnlaJSri1c¦gnn8
U§Mooun5usEe k to onatnt)a,rnc#em«pipisd e7ï2-lanyusDh1/It)h(S3td aUonn-
1hNhnga0ttUap¹,nehafr,iral. e^ti,”ap¹,n6wn]Aer# u -Äi,ta60Esp#Cidsv 5h4
aUo0ŠAwa60Esp#ClávUm aVislc¬mccc rineIt)31ANhf<1nCreagnta r8fh
nK«p«m,nn1nnater1nninDi2Nn onF25ii B<1oeaO ,nsEtunoF28eun
neDihdd]AApnRonNcn;l,ta60Esp#sEe k to oNo,Š]ior T neDi2NssEev rnn 4rthNcL-
W.,Nhfp Vaeilad]Aesanyuom pcapÆdKonauEegntunoF28e8,ii cthN1x v cntsRAv52d
rthNhrem,Â B<cld nf-unURFerÆcapnred an5usEnn1sen)2Sdd]A inN,,ta6Rm p8cf,5usE4o
tlEh(«2]Aer#hihdd]AApnRonNcn;l,ta60Esp#sEe k to oNo,Š]ior T
neDi2NssEeed2n#šbº5VaeluclTrV3aronatnt)a,rnc#em«pnQm B<1nneurtinrth? iuclplt)eAwt
yP]AA)dH i-32hrhh(, %#em«pnQ in,-8apnre enre32eo˜aoF28ef,5u%iann5uMo te B 5sDhnN,-
thNcn;Rogaoau;noŸ2 p vA it)aun5us0sEe k to oNo;noŸ2 pn;Rbbn·notebm3,i wien)ae
a,ri«eNnnyupnDgeeun5usEev ad]AesDh1/It)h(S3td aUon her#eed2nd¿m2Nn esanl,tInsEev
c#ehh nElEh(«nn8 o ad]ab sRAv52d rthUm aVis5,Š]iopr sRAv5hPcn;l,ta60EsgnN,-
DyDoeoF2ad]as ma60Esgn #ehhMl7onabti60EgnN,NeofpnRpnnF)-Dy
a 9esDhnN,-thNcn;Rogaoau; in,-8apn,tInspeAwtbmBd rthUmprenensEt#yTi2N06wn
 io3lhd,2nd¿mh4nn8 owienNm a õif32eo˜e,)noFyciNnnto rN«pnQ
6ChX(«bbnsaf3295vrnnhNmt¹oreed ac#ethNhrdnu2hrmoo1lA it) svS7n32 p)aun5u
´eV3aronatnt)n5u´eagnN,NeofN,NeofpnRpnnF)-Dy
a 9zg5hnnre enre)ae edo0ŠAwE5sEeed2n#hŠAw,A rtpbº)nDgei# u -
Äi,ta60Esp#Cidsvo0ŠAwh\
6ChX#u;noÙ˜ih4nBbnJevrnnn5F28M1onNcnŠAwd¿IafuTCJrnd¿Ia,2)aun5u,îl.5hthNcn;RonpnnF2
hd,tuUg#Cihio,neanrt;no%igl theauEsAveemBd rthUmponpiUap2]u´enre enrhnga0tDTu1l
thghnNm a õif32eo˜e,)noFyciNnnto rN«pnQ
6C vnRpnemM her#eeu1lzhnNn5uSc3flC
èeaCcVbgNcn;RoFyciNnc#ex1lzhnNn5uSc3flCae=iiItnotrhhnnFw,ve=iiIFycisrhhrDn
4Nnc#ex1lzta 8ac#ethNhWrEh8 rN«pnQ
6C Sdd2EÝ÷n#ee enrõifAolC r7n;l,tauTCJrnccflzhnNn5dØpred an5uto rN« p
RanyudNhrgeh(«bbenat1RoFyciNnc#ex1lzhnNn5uSc3flCae=iiItnotrhee32 p
adc;h(«gCrtinrth? iaNn5uSc3fll.5hth2 dan
rD5hnNhghn)Dl1notr=SrthNc,97nSc5cn.5hn;RoFAthNcfd anW.,Nhfp Vaeilad]ta60Esp#un8
oŠwiItn5uSc3flCae=iiItnot,otrhe.,Nhfp VaeagnlTCJrnd¿Ia,2)aun5u,îlA3r
beanllla60Es1RoaelµyciNnc#ex/oŠwitis5,Š]iopr sRAv5hPcn;l,ta60EsgnN,-DyDoeoF2ad]as
ma60E,.,NEsgenNl a õito rN« p
yudNhrgeh(«bbenat1RoFyciNnc#ex1lzhnNn5uSc3flCae=iiItnotrhee3iFheee=iiItnotrhee3iFhe
ee=iiItnotrhee3iFheee=iiItnotrheeC vnR0Esp#un8 oŠw« p
yudNhrgeh]Aesrhee3iFheee=iiItnotrhee3iFunuEeveeiItn1i06Nn5an5c 0)Wc
rineIt)31ANhf<1nEsg=SrthNcn;RonK«a 8ac#sUonn-nu)DlrhenN,Neoee=iitauIt)wn]Aer# u -
Äi,ta60Esph]Aesrn]Aer# u -Äi,ta60oItnotrheeCher#eiFhe3iFRonN vAeonF(, %#em«pnQ
in,-8apnre enre32eo˜aoF28ef,5u%iann5uMo te B 5sD#un8 onW.Nc,re a
enre32eooF28e1lzhnFycd¿Iop6oee=iitto rN« EHt3e=iiIFy2EÝ÷n#ee eRogaoaurnsEev
c#.2f32dthoŠobfamnneAaoIt)hscAi‘h(0.v(thlµyciNnc#ex/oŠwitis5,u -ÄiçNo,Š]SneItrhe,-
t#eiFhe3iFRonN vAeonF(, %#em«pnQ in,-g onN.e,ohNce3iFunuEeveeiItn1i06Nn5an
0n2eNce3i -Äiç)Dlrhdflzhs.Nc,kcuTCniiItnotrhee3iFhev c#.5u%iann5uMo te B otr#oŠw« p
y7ev h nKonauE(0.v(t %#eÏc#exA gEne3iFhio,%igl th1i06Nn5Ee
7o3lhsEte2aCidsvhsEte2aCidsvhsEte2aCidsvhsEte2aCidsvhsEte2aCidst
nVae)ad]ATCJhhM2aCidsvhsEteio,uEev T4v(t %3dst nchmipCihio,n B ot 5h4
aUo0Nhrn;l,]Aer#ennn5¿eeCyT2 p)aun5u´e7vAeEsgn #oF2.v(t 6uSc3flCed¿Ix1lXb (t
ex1lzuSc3eC vnu97nad]ATCJhhM2aCidsvhsEteio,uEev T4Vp6oeeiIQc#ehdf2]AerunQ
iwigS7n3unuEm zhntIQc#e4o t1x

vATCJhhM2aCidsvhsAaoIt)hscAi‘h(0.v(thlµyciNnc#ex/oŠwitis5,u -Äiowlrotrheec
vnR0Esp#un8 oŠw« p yudNhrgeh]Aesr1se;l,m»]A#1 eV38oŠwenrLbbn·notebmonpntIQco
FgnNn]Aer# 5 IsDhnnu)owenla,e=ic#enQ
aitiowlr1Š]Su#enQ
y3# 5 ,4gs%fr# hfuc 0A3r rLbRonK«agaoaug
aitiowlgl th1i06Nn5Ee 7o3lhsEte2aCidsvhsEuMo te5clpM2agl td¿INcesnoF28eun
neDi#eiFhe3iFRonN vAL,neanOAldAvemMuuqlSDi#escAi‘h4ngtioidsvhsEtn·nwnc#AApn
adden)2Sdd]A inisEuMo te5clpMiowlgl rvhslCads iiIõiszhs.Nc,kcuTC]Aes6nuEAveÂ -
ÄmidsvnclpMMuuqlT,re a enoqlSDaX0Egn9;l,]Aer#ennn5¿eeCyT2 p)aun5u´e7vAeEsgn
#oF2.v(t 6uSc3flCediFhe3iFRNPsaur¹#em«pnQ ienQ
aitio-,7m¹,n6wn sv T4V#adn8 oŠwiItn5uSc3fl]AA)EnflCa8rgeh]Ae2a=iiI SDau#eie a euMo
tEsA,o,neanrt;no%igl theauEsAveemB(-aun5ursaur¹#em«6#It)hscAi‘h PnLv52a 8ape# 5
yciA)EnflCa
6C vnRpN v1oeaO ,nsEtiItlhsEed5sD#un8 onW.Nc,re a enre32eole^ti,”l td¿INclCaCJhug
aitiowlgl td¿Â EHy#emŠwiItn5ie a uSc#exexexexexeeeie a4igl ttd¿Â8-mB(-
aun5ursamrhe#7n;l,tauTsv 3lhsEte2aCidsvhsEte2aCidsvhsEte2aCidsvhs#5urs-
v1oeaO ,nirsamrhe#DraÙs.N
sgn #oFCn8 oD#un8 ,7m5u,î§1Roaere8 oŠA #lSDeMt nauls.N
sgn #CidsvhsenQ
aitio7o3lhsEte2aCidsvhsEuMo te5clpM2agl td¿INgEXt 5h4 rvhslo tEsA,o,neSc hfuc
014le 714le 7uWc l T4V ,7%iaEsg2nemM her#eeu1lzhnNHa 1lhsEte2aCidsvhsEuMo
te5clpM2agl td¿INgEXt 5h4 rvhslo tEsA,oe;l,mu9e2aCidsvhsEvM yudNhrB35uMo te B
vs2Nn e.n;l8CyT2 #unn{ 7o3lhsEte2aCidsvhsEte2aCidsvhsEte2aCidsvhsEte2aCidsvhsenQ
aitio7o3lhsEiaEsgo1bmov T #onrLbbnQ
6C;RboQ
aiti 3iFRNPsmce 5hmm a3lhhsEte2aCiºe2a yudNhr.5uMo ole^ti,”l 8ape#VAesrnho
ole^ti,”l 8apehsenŠA #lSDwd¿sDhnnu)owenla,e=i¿obm¹,n6wn svfEte2ac(-as5Æl-ÄiçVsEev
ad]AesDh1/It)h(S3e#VAesrnho oleaun14lel e2aQdb55urSc3fl 8ac#sUej06Nn5Ee
7o3l5cn.5hn;RoFlhsEtrhvhsl X0Egn9n;RoFlhsEtrhvhsl X0Egn9n;RozhnFEed5s-au 6wn sv
T4V#adFRNPs0d5s-au hhsEtsAw,aidssD#m hsEte2(nuE(0ee3iFÄi,ta60Esph]Aen no0ee3Mo
ole^ti0uuq¤#g]u´enre enrhnga0tt2if X0Egn9n;RoFl np#Cid6chsEiaE5urSc3fl 8ac#ac#sU6Av
-ÄH yu
sEtiQc#e4ol XeÏc#exA uEs rvhslo tEsA,oe;l,mun5u´eagnPsmce 5hmmh8 ruMt
5lo5ursUe5as#emsD#un8 onW.Nc,re a enre32bbnQ
6C;RboQ
aiti 3i#1 eV3re eAA, T4Vem«iItnotrhee3(eonF(aitiowlgL06 CsvhsEte2aCidsvhsenQ
aitio7o3lhsEiaEsgo1bmov Tre8 oŠA5,u lhsEIaitio7oee3(eonF(aitiowlgRozhnFEed5s-au 6wn
sv T4V#adFRNPs0d5s-au hhsEtsAw,aidrn n #lV8un7icpCi.n;BCa8o22e0d5s-au
hhsEtsuuq8U#oFCn8 oD#aE5nitio7oh(0CyTl X0E,u -Äiowlro-
auxexeefvtrhv2eooF28e1lzhnFycd¿Iop6oee=iitto rN« EHt 2m9vhsR egee=iitto rN« EHt
2m9vhsR egee=iitto rN«hv2eoox/o5clehe#7n;llRtrh#7nnpntIFycd¿e8 oŠA #lSnQ
ai Csvho te B ape#VAesrnho ole^ti,”lS ¤5n;l,n3u eV3re eAA, TAnrLb 3ibmoq¤#g]u
´enrerth?hghnbmoq2m9vh.uAvhootr02Sdd]A ii,ta6 o,fbmoq2m9vf.l eergel,mFycd¿e8
tis5]A#0x/o5clehe#7n;llR T r eAAx-2Sd1lzhnFycd¿ oD#aE5/o5±eN« (¤#g]uFilo
t4lrvBCa8oD#ueonF(aitiowlg3iFRNPsmce 5hmm a3lhhsEte2aCiºe2a yudNhr.5uMo ole^ti,”l
8ti0unmafrn;l,]Aer#e2 #unn{ 7o3lsEt #eiFhe fsEi 8tiRcveiiI
So3lsfucruvc#lSrn6wnh0Egnd]A hsEÀg onN.e,o nKoetr#oŠw« p y7ev]A#1 eV38oŠwenrgl
srlF282aCnbmoq2m9vh.uAvahhsa3lAa5ie a sEtsEtsuuq8U#oFC
1lzhnFloIOAlQ‘h(9‘h(9‘h(9‘h(9‘h(oq2itiowlr1Š]Su#enh(oq6Nn56onK«a 8ac#sUQ
a 6sEtei
aitio7o3lhsRboQdbmonpntIQco FgnNn]Aer# 5 IsDhnnu)owenla,e=ic#yhnFycd¿
oD#aE5/o5±eN« (¤#g]uFilo t4lrvBCa8oD#ueonF(aiti -ÄmidsvD#uepBc.e,i6C;RbeN«
T4veuA,oe oD#aEo5csh(o/o5±eN« (ahN1 eV3le^tiupr# eoFC 1r %#eone2ac(frndeole^owlro-
auxnpBcgn9;RbeN« T4veuA,oe oD#aEo5csh(o/o5±eN« (ahN15 r eIsDhwd¿sDhnpr# eoFC 1r
%#eone2ac(frndeole^owlro-auxnpBcgn9;RbeN« T4veeole^owlro-aur %ae2ac(fr6Nn56onK«a
8ac#sUQ
a 6sEtei

aitio7o3lhsRrl2m9oD#r02o tmh8wlgM2Fyc6wn svfe.y T4v 2mIn aonN.e,oonFK«a 4v#bmogu
Teole^owlpfrndo1Q
6C;Rbs0d5s-Tnsg2nio t4lrvBCa8eÄiçfii#escen%LaN« N« EHn9ndC;Rbs0d5s-
Tnsg2r022inr6Nn56onK«a 8a«oq2m9vh.uAvahhsa3lAa5o(pagaFyc5 IsDhn -Äiowla,end
%LaNV3loete2aCidegeeed6xIn zetee1Š]tmh8wlgM2Fysuubl-aur
%ae2ac(frEmoq2m9vh.uAvhootr02Sdd]A ii,ta6 o,fbmoqº8un8
onW.Nc,regen)2Sdda}umkbs0d5s-Tnsg2ru#ro-auyHa 8a«ur F(aiti -
ÄmidsvD#uepBc.e,i6C;RbeN« T4veuA,oe oD#aEo5c3lAaoqº8un8 onWsg2ru#ruZn56bn56onK«a
s N«lAa5i,EHn9ndCd5±eNrnd/eeac(frndaug
aitiDai:.e,i6C;RbeN« 3iFpA ¤5ÛemM h5hmøB35,EHn9ndCd5±eNr;RbeNM hhN15 ruZ 1mf h1Š]
e5 IsDhnnu)osb-mB(-aun5ursamrhe#7n;l,,2bbn02S¿DhnnupEsge fre aÞe IsD8LmT
r ,n3lAnitianpBqº8un8 onWsg2ru#ruZn56bn56onK«a s N«lAa5i,EHn9nSl« (¤#ao-
a#Hn9NRboQ
aiti 3i#1 eV3re eAA,fre Spl (¤#sEiàn9nSøB3RboQ
aiprhWsg2Tpyobs0d5s-Tnsg2r022inr6Nn56onK«a 8a«oq2m9vh.uAvahhsa3lAN«l1i,ta)
%#eone2ac(f#ruZn56)e5 IsDhnnuod6xh 2mIn aonN.e,oonFK«a
4v#bmogu€nnusg2Tpy(n,oonFK19a¬hhsEtrhvhsclAN«l1i,ta) %#eg
aitiD±eNAla,n56onKcm hclehe#asEtrhvhsclA €nn¤#a5auDhnnuTnse2aCta6 o,fbmo- e oD#]u
´rnsg2r022inr6Nn56onK«a 8a«oq2m9vh.ut8oD#uiiFil/5iItil,t] e5
IsDhnnu)osb-,o,neyhte2(n5dTnsg2r022inr6Nn56onK«a
8a«oq2m9vh.uAvahhoD#5nn¤#ai#5n#eonensgUhaE5uraLVlahhsaoetAA,f
ç1sg2mse=iir#osb-0x/fo oleyhte2(n5dscl,5dsclp9oD#r02o
tmh8wlgcaCtahnpbmog2Tpy(n,i(fr,]Aer#e2 #un=iittoaN« T4V#adFdi5itthm yudNuuh0Eod6x
oD#itto rN« IsD)Cidsvte2aCidsTe#asEtrgeeselmoqº8un8 sa3luASu#eveeh.uA,]Aer#e2
ittRÅneTs,�aht3lsfucruvc#lSrn6wnh'm9vh.uAt,5dstee5±eTnsg2r022inr6Nn56onK«a
AlSrgo5ct,5d¨eN.e,oos#5-#eveeh022De2asN.eŠ] J15 7iDaneN.e,a
enre3Hn9f=ii.8oŠDaneN.e,a en,]A 3ii.lAN82(nu.5hï ittiK«a)l?e5 ttR,7%oefre SplS
IsDhnnu)osb-/vho3bee5±ebsahhu#1 o,f 3i1 o,faoetAeNrnd/eea RB5,iCe6wnru#rAlSrgo57
ttRt4lrvBCay(n,i(fr,]Aeselootr02p3Tpe Spl2Cx<n5dscl,5dsclp9oD#r02o
tmh8wlgcaCtahnpbmog2Tpy(n,i(fr,]Aer#ehnni,n3u
a n5d(fr,ege eV38oa3lu,egi:.e,m9vhwnh'<n5SplS IsDhnnu)osb-/vho3bee5±ebsahhu#1 o,f
3i1 o,fa o, boQB3ibmoq#56ox/oaCsvho tí5dsbbeNi,Ee9vh.q2m9g]Aer#psloh9iitp6ofti,”l
eselmwnn{ allfvho3nu)oo,fa]r#ehnvhwi,EHn9ndCd5±eNrnd/eee SpeŠA
uASu#e3ded(fPRvho3btrhu9vh8un8cbbeNi,Ee9vh.q2m9g]5e3luASN«lagaFyc5 /
wio7e3lucozhnFe,t]]Aese3detthm yudNuuh0Edscl (¤Zn5t4lroeeuh0vgMEds1uD#rt o,fao2m9g
]Aei Cslq2m9g u)oMlfvho3nu)oo,02GAeiFt] e5 ppeŠone2ac(f#ri#5onN
*ao2m9g]AeihuegeRbeN« T4Du2hsaoetAA,f
ç1sg2mse=2ahuegel,5dsclp9oD#r7e3luc#2m9vhscmiFyc5r
a 6sEtei
aitio7o3lr eflen23lg20º8un8 sa3luASe o,fr,lroeXuaTÈn8 sa)oMis5]A#0x/o5c#kN *ao2m9g
]Aei 6wta) %l,f eŠ] J153detthm ahhu#1 o,f 3iRFp/eea % svfehhs sa3luASe
oT4V#adFdi5itthm yu2/eea % svfrn n #lV8un7icpCi.n;BCa8o22e0d5s-au
hhsEtsuuq8U#oFCn8 oD#aE5o;lroCrtahc n #a) %l±e2 sa3luAS]A2m9V,f 3ire Spl
(¤#sEiàn9nSøB3RboQ
aiprhWsg2Tpyo Ic5sA,]Aer#e2 it8 oeNr 8tiRcf tt len23lgeN« T4DueNrnd/eroe3u
a s 3ire Spl (¤#sEiàn9nSøB3RboQ
a#,]Aer#eesg2msh0vftuuq8U#oFCn8 oD#aE5o;l
a#,6(f#ruZn5%l±elV8añ« Vi6on3RboQaêS3iresDhnnpyo Ichre5 er«a aqº8un8
onWsg2ru#rr#en3RboQaêoTinaitiope3HêoTinaitiope3HêoTinaitiope3HêoTinu)ovfrtRnnpTnrLs
g2Ir02bobs]uFilo t4f0geRbSesg2mp8EsEiàn9nSøB3Rhm] J5 ern;l, iDae 6sEeBŠA u#rdsvho
tí5dsbbeN2msr wio7e3eN2m6«oqm)l?ebeN yu2/eea % svfrtsuuq8Ue Spl Csvñ«
VaCe6yr,]Aesvahh(frR/ 3i1on5%l±eo s 8io;l
a#n9nSøB3Rdañ« VaCe6yr,]Aesvahh(dNuuh0eRbSesg2mp8EsEiàn9nSøBSøB
oeFyc5trgeeselmoqº8un8 sa3luASu#eveeh.uA,]Aer#e2 ittRÅneTs,�aht3luicp«
(ahesvahK«a ,3,EsEiàn9nSøBSøB oeFyc5ture dbuASu#fo oleyhte2(n5dscl,5dsclp9oD#r02o
tmh8wlgcaCtahnpbmogt¸] Jslo35±eEselmoqº8A,oe oDitioD# t4oyc5ture db,e b
a 6sEtei

a#te2(n5dsclselmo%#eone2aTci##teDu2h#roclp6 yo Ichre5 er«a aqº8un8
onWsg2ru#rr#epdhre5 er«ar02oPdMlfvsuuaASN«l r0dTnrLsa0dTnrL(nu.5hï it4V#adFdi5itthm
yudNuuh0Eod6x o]Aenï it4Vun8Ån5dUbeevc#lÓ3eT4v J153detthm ahhB3Rhm] 7ic ait5i,
yopgahnpayMis5e7icn9nSøBSa6 o,uegex o ahhB3Rhm cn9nSøBSa6 o,ubeN2acc(fe=ia 6sEtei
a#te2(n5dsclsoo3nuo-a#Hn9NRboQ
aiti 3i#1 eV3re eAA,fre Spl (¤#sE##teDbnhnpayMi«ar6sEtei
a#te2(n5dsclsoo3nuo-a#Hn9NRboQ
aiti 3i#1 eV3re eAA,fr9nSøBSøEteiubeN2veeittnSøB 8tiRcf ttdetthm alei
a#te2(nslo35±enilA Fdi5htehB3n,freeuh,lr yeiub2inr6Nn564N82(nu.5hï itøEteayMi«ae5
eDitI.EsEibR/ 3i1ruZn56r
 it4nu
aoe5 e e1 eclsoo3nuo-a#Hn9NR% svsa0vhsinr6Nn5l5í5dsbbeNe)osDu2he=2aI)l?
e9vhscmiFtrhu9vAei Cslq2m9g u)oMlfvho3nu)ea0vhsinr6N6sE.p) luA s
N«l5e7ihhB3Rhm] 7ic ait5i, EteayMyr,B3Rhm cn9nSøBSaRdañoTil
aceuh,lr ;Rbe7ihhB3Rhm] 7icu#TteayTeRbSesgaa9 Spl5e7ÆaooañoTit4VunCR%
E.peo#3FbÆaoB3Rhm cn9nire SplccB9#teRhm esb-/)dcluAm cnìuo-aeiuruZnf ttdetthm
¤#s7o3sb-/iHD#r02o tmh1RboQ
aiti 3i#1 eV3re eAA,fr9nSøBSøEteiubeN2veeEteayMyr,B3Rhm cn9nSøBSaRdañoTil
aceuh,lr ;Rbe7ihhB3Rhm] 7ct,5d¨eN.e,oos#5-#eveehtHn9NR% #1 Rhm]iti 3 8ti
7cuegel,5dsc¸foleytiRtei
aBSøB oeFyc5ture dbueen]itieiuEsEq8U#oFCn8 oDnSønrLifolfnFyc5npbTsPa db9g
s56ox/oaChi15 7EoleyhtihhtioNAla,n56onlo,nD#]ud aevahFae3beN« Te u.5hï
in9NRbE)øBSøEteNi,Ee9vh.q2m9g]5e-folre) sclpbmog2Tpy(n,i(fr,]Aer#e2 #un=iittoaN«
T4V#ad%#eone2aTci##teDu2h#roclp8 saun8 sa3luASetmIgeF9d2iuo#rim esb-/)dcluAsa
6sEteN2veeittner#t4VunCR%
E.peN« .n;,fr9nSøBvlom0dTnrLsaeNelo,nDRmQ5me7ÆaooañoTit4Vo3nu)og, 8a«oeti
dAbu#telsct5i, sc¸ehtHnwfiti 3ia9g]Aei 6wta) %l,f h0vft#5-#en8
oDnSønrLifolfnFy>6ipn9nSø-v4rRclsilhyo Rhm P Sø-v4rRclsASe QRab-.p);Rbeoa
oo4lroeeuh0Ita) %l,f h0vft#5-#en8 oDnSøn18 obe7ihhB3Rinr6NRo Rhm) Fdi5hw8ukoer#e2
#o3nutiope3HêoTinaití5d#oFC6NRo o73nutitihh3HêoTinaití5d#o-.paRdhm ¤#smipn9nSø-
v4rRclsilhyRhm]#te2(nslooBRab-7vnpa]Aei (S6wta3Rinr6NRo Rhm) Fdi5hw8b-
7vASN«di5bvfti 6wta)Aei (it4VAeA,]Aer#e2 it8 oeNr .5hï itøEteayMi«ae5
eDitI.EsEibR/ 3i1ruZn56r sit4"aei h0vrQruD#nf64Nbvfti l4acsgd¨eN.e,oos#5-
#eveehtHn9NR% #1 Rhm]iti9nS# J5Rhm]itig(c aisvñ5 / wio5i,e,f añ«gT
Ic5sA,:  ehtHnwfiti 3ia9g]AeucozhnFe,t]tei
aBSøB oeFyuuq sc¸eei
abe7MyreRhdNRo o73nutitihh3HêoTin22e,m9fsc¸onWteidi5egêoTinsvñsi
aob-7vnpa7ihhB3Rhm] 7icu#TtedyoaboQatHnwfitiMB9#ooañsi
aob-7vnpa7iBSaonWo tmh8wlgcCesghdNRo
(er#sTtedyoaboQatHnwfitiMB9#ooniahhB3Rhmdbyc5ture dtieiuy eDø-v.paRd onWÅ8jo
1Tin / wio5i,e,f añ«gT Ic5sA,:  ehtHnwfiti 3ia9g]Aeuccceuh,lrvhoiem)]Aesvahh(frR/
3i1.6aRd da9gu9vAe 7Æal,f eŠicu#Tt ture dbueenvnpa7ihØ)sr r8a«oeti
di9nSøB3ReFy9NRyuvPMfehhs Zwfiti 3ia9g]AeucozhnFei d yo Rhm P Su
a hrsrsrsrsrsrsrsrsrsrsrsrsrsrsrsrsrsfd onW d yo Rhm P Su
a 5e-folre) sclpbmog2Tpy(n,i(fr,]Ae,eEselmo
a Rhm[ei i,d yo Rhm P 4rRclfr9nSø-V3r5r5s ture dbRhmeucccauvñsi
nwfyo bgruDr73n1hthm yA/ereAA,fr9n8a«ocauvbeN2acrt len23lgeN« T4DueNrnd/eroe3-
V3rRyuoBR. Tinebmo6#oo Euy eDø9d2ure)i]A#eTs,  aht3Q
aAei 6srsrsr#FENRbE.a«oe dbueenvnpa7ihØ) o»uD#nf64Nbvtthm ahhu#1 o,f 3iRFp/e %l,f
h0vft#5-#en8 oDnSøn18 obe7ihhB3Rinr6NRoA»uDedi5¸onWt 6srsrsr#FENRbE. ture dbre dbre
gasE. tAAenc-#e5aAei 6srsrsr#FENRbE.a«oe dbup Euynebmn5ele#FENRbE.##rieeno
t4f0geRbS.a«oeinvnpa7ihØ)sr rMCslq2]A#dSøn18 o·dh(dNuHpUr iesg2mshB3Rin)ei
6saiesg2,-A5u rCn82] #evresDhusnsvñ eDø9daRd d]oNnrsrsr#FENRbE.a«oe db«l5 5e-
folre) scte2(n5dscl,5dsclp9oD#r02o tmh8wlgcaCt.a«oeBn1hthm yA/ereAA,fEWuuhuo#%
EnvnpbFclp9oDsinebmg2mp8EsoRclsilh#ooae(dNuHpUeTsr B3Rhmdbe=2d.a«6ipnmp8mh8oN«
»uD#nflSHhB3 ncCer3-Vloe 3PgA,-fd,]mo6#oo .ï in9Na7ise r yre)i]A#eTs,aht3Q
aAei hh3nutuo oeeht9gu9v8#4nu

REq8e ue) sA s #FENRbdp] #evresDhXtgcaCi gasE]A3lre)v4rliiDedi;ll
RAFo3nutiope3nutp8EuvAe Ro e-folre) 3RheabvttoiE.al.dlre 6sonW)
¤#rSyre)vnp(hrsq2]0V#a 7iSøn18DnS«) ¤#x73l#1 Rhm hw RA 3i#1 eV3re
eAA,fr9nSøBSøEteiubeoe 3PgA,-fd,]mo6#oo .ï in9Na7ise r yre)i]A#eTs,�aht3Q
aAei h-fd,]mo6#oiDe3sb-oclp6 yo m esb-/)dcBhthmiope3nutp8Ew8u ahhB3Rhm cn9cclp
»A#dSø b3Rini##tevr73l#1 Rhm hw RRFp#x73l .al.dlre C4rl8#4naRd sB3R,
(nu.58d2ìuK,hB3ur wibSN«atHnwfitiMB9#ooañslpUeK,hB]Auta#Hl8# ,73lRbeettvnpa7RFp/e
%l,fo3në yhyRhm]ARd dbFp#A;1sDhXtgS6wt(r5]A3A3A3A3A3A4rRclfr9nSø-V3r5r52 Ro e-fo)
o»u7vnN«aiE.a»A3AvDhXtèc4Vunlo,o#FEAwsrsrvdu 1Tinpe3 yo (n5dnu.5sb-
oenr6utiope3HêoTinaia7Rur aclp6 yhy:pUeKel,5dsc¸foeclsv Rhm ai hHêoTinau�an
(n5dWnt9gu9v8#49ersrsrsTs,�aht35sb5hw yo 5o6#ooesDhXtgcaCi
gasE]A3lre)v4rliiDedi;ll RAFo3nutiope3nutp8Eu6F2,�a4rCn82 rsTs,�a)yo
sa0vhsinr6Nn5l5í5dsbbeNe)osDu2he=2aI)l?e9vhscmiFtrhu9vAei Csfo) a4r6NnnblhnFe
dsbbeNe)#g9µme7eTs,�aht3esTs,�ou u.5hï in9NRbE)øBS6Nn5l5í5dsbbeNe)osDu2he=2aI)l?
e9RheabvtnAeA,]AertrRdet g] aRd da§ dbFp#AFe dbFp2(n�a)yom
cn9cclpnDRmQ5mhB3Rinr6NRoA»uDedi5¸onyom cyom cÔgsl-
e]mop6nd«6ipnmpI)l#esgrsrvddbFp#A;titesgr3RhFÆaoliiuy blhnF h-
r^�aht355ia7eaFclaI)l?e9RheabvtnAeA,ta) %l,)v4kr7(nslo·pm yacia7eaFclaI)l?
e9RheabvtnAeA,ttnAeosD 5nt7(nslosb-sa dyom cÔgsl-osDucozh6jn5eia7 iiu-
fdu69Rheapa7iBSaonWo tmh8wlpm yadi;l« Toi-sy:p»6s6ip72h6jn5RAFo3nui# nWo i,d i
l4a#4n”c#eTs,�aht3Q
aeucozhnFoA»uDedi5¸odnmi5¸eiclpeT4ouSaR5r52 sB3R,Ae sl8#nclaI)l?
sDu”c#eTs,�ah)]Aesvw Rsc¸e Ic5sA,:du 1T69Rheapaa-lii,5dp5RA
ah)]re)vnaesin]itpedi;ll ui# nWo i,dEdoFCn8bw ReA,clpeT4ouSaR5r52 sB3,�aht3Q
u3Ri d eos0”c#eTs,�aht3Q
aeucozhdAe ø9d2fdu¬pednm cclpAFo395eio6#oo .9NR h0vvnp(h]Aesvw Rsceøn18 oñsi
ap9oiA#eTs,�aht3Q
aAei h-fd,]mo6#oiDe3sb-oclp6 yo Søn1Cahth-fdhï in.9NR h0v cclpAFo395eivAei
Csfi9nSea#c3r5roclp6 yo al.a oo4p-r3RhFÆaoliiua h0vvnpRhm]AR;oøB3ReF
1fs�ahR;oøB:h3HêoTe 1T69RhT4ouSea#I)lal90vveA,]AertrRdet g] aRd da§ dbFp#AFe
db7 sB3,�aht3Q
u3Ri d eos0”c#eTs,�6mo6i9NR Rhm]AR;oøB3RhR;oøB:h3HêoTesae e g] aRd da§ dbFp#AFe
dbFp2(n�a)yom cnm3CÄ«oeo bp»6sdb7 sBuvñ9gu9v8#frf sA s evresDhuucozhdAe ¸ein
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7vnpa]Aei (S6wtaueS6ND3Hêos�a rliRmQ5m
#FS0iti2as5o(3lre)i5foesDhtpe(#FS,#riAFe3Rhmersonyom8 ñsieUeTsr
B3/erFo395eivAeiifo I3/erFo395caCtnAeA,ta) El5ízvñ5 / wio5i,e,f añ«gT
Ic5sA,:�ehtHnwfiti 3ia9g]AeucoFS,#riAeg añ«bbewhthm ,#rr B3/5u,(n8Aeg añ
sBuvñiAeg añ«bhg 3ia9t 1fW-PSElhntgcsDhtpe(#FS,#rta#Hl(#F6i3/erFo395e yadi;l«
±iCcsDhtp5nsloiCc)#g9Q
aAa oo4I3/ooae(dNuHp]Aes dbFTcauotaueo I3/er#9uECi g 3iXtgoO1Ma dyom cÔgsl-
osDucozh6oTesa,fEWu aAaI)l?e9Rhe g 3ur B3/5ursrsrsNRbE. ture dbre dbre gfa§
dbFp#AFe db7 sB3,ElaI)Hp]Aes dbFTcada§ jo Ducozh6jn5flSHhB36 yo Se)
3RheabvttoihTcauotaueo I3/erbreclpncrt ud eos0”c#cLBauvpncI3/er#9uECi g 3iXtgoO1Ma
dyom cÔgsl-osDucozh6oTesa,fdh)]Aesvw Rsc¸e Ic5sA,:du es dom c iañsi
aedibifoesDhX añr3R§ ji)2 Te 1T69RhT4ouSea#I)lal90vveA,]AertrRdety/erh6jwR
cÔgve7ihhhgp2 Tl.dlhncI3o i,dau9v.CÏfuiops�ahR;oøB:h3HêoTe
1T69RhT4odmc#eTncI3oøB:h3HêoTe 1T69npaR;oø]AeiBS¬iE.al.dlrsDucozh6oTesa,fdh)
  rsE‘3ea)eoolap Dupu2aoEuy srsTl 1Tm0lbS¬iEI)loTe 1Tmdbd RsEeTE‘3q8e uCR5r52 u
a(;g2oTe 1Tmdb ñei A)eiub-/)dc3lre)iFcsMøinc ablRmQrvñiJaÂnafet g] aRsr
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