Circumlunar Transmissions

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wholesomedonut joneworlds tfurrows solderpunk durtal

1202 yaM

SHELL-TO-SHELF

Circumlunar Transmissions Issue One May 2021

Edited by mieum Produced by the sundogs of circumlunar.space Typeset using KOMA-Script and IMEX

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Contents

how these influence the exclusively over Gopher relatively brief inhabita--be bne toggest and adand creative individuals It has been a pleasure

irst issue is a kind of pilot contents from their own telem, about the possi- fun experiment, and this of the project and serve its circumlunar.space BBS, the air. It's really just a one can clone the git repo wondered out loud on the duced is largely still up in or capsule. That is, anyand how it will be pro- on their own gopherhole \mathbf{D} around the time of rently what the zine is would like to host a copy zine over time, but cur- and Gemini by whoever

sions will be distributed mire sincerely. During my -simener Transmisand backgrounds of the a nutritious one at that. Initial out to be quite munity of thoughtful salad." And I believe it to this wonderful comdearingly termed a "topic to contribute something -иә иәәд ѕец зецм әлец So for this first issue, we to distribute locally. the pleasure of perus- a go and see what we get. own enjoyment offline or elected to first just give it print-and-bind for their produced any content, we bial editor pants-for this without actually having provide printable formats into a niche or format ini editions, we intend to pidgeonholing ourselves tion to Gopher and Geming what it should be, or cessible way. In addiour energy on determin- such a thing in an acprematurely exhausting where and how to bi-host out there. Rather than of the logistical issues of run has been to just get it distribution solves a lot The strategy of this first .9bosiq9

will be interesting to see it .brand anibiss residing here. It sity of interests, talents, of the impressive diverlunar.space will be aware gemlogs here at circumbng the many phlogs and bed sed odw snoynA inaugural issue, at least. up wearing the proverbilee, I somehow ended -ul sidt tabimA .tnam at the moon in exciteas we proceeded to howl melet behooft enix ent to and for some time, talk the rest of us and the test of tes idea was well-received by bility of a CS zine. The the ogre incident, Jone

 ${f B}$ eck in February,

Preface

6 Why I Still Game Proprietary

newcomers. It's hard to involved in FOSS gaming then. It was written in a FOSS project being un- and explore once (or it

this world of free-as-inare also interested in free I encourage people who

the wall overtly trying quality, variety, and combeating my head against a growth in production but I don't see the point in will consequently drive tion and playerbase that will not see the requisite run on them will not be board new people from

is true regardless of genre, play video games which game shut. That concept soffin of any fledgling three things will nail the Day ple to play it with. Those At the End of the hard to find other peoat always, and sometimes use at first, hard to look of their own volition.

Call me the gaming uptick in talent, contribubase to share it with. an even smaller player- seen. And therefore we smaller content base with fine myself to a much systems or the games that that "just works," or con- icant adoption of FOSS and C) want something all walks of life, signiftor free-as-in-freedom, have a heart that beats we make it easier to onnically inclined, B) don't with a grain of salt. Until ple that A) aren't tech- freedom/beer/whatever play with average peohere. I can choose to of inviting others into put the pieces together to consider the prospect So, I leave it to you to and open source software art style, or UI/UX.

stands out to me as one platform for those new- time. ket space of people's free petitiveness in the marnerd Whore of Babylon,

.98672 stating them to set the in this context. I'm only facts that are immutable time bemoaning those what it is. I won't waste That's a given. And it is tions were still common. -opino du-laid -opino connectime of online gaming, solidly a relic of an earlier tributable program. It's easy cross-platform disits' foibles makes a very foul JVM!), which for all Java (yea verily, begone derstandably opaque to ever) they choose to get most things were back of the prime examples of comers to even stand on

Interesting Impasse na ta ttal m'l

tions. However, it also and open if there isn't a base spanning genera- to make my hobby free tranchise that has a tanputerization of a niche is: a highly detailed compose very well for what it Megamek serves its' pura great degree of fidelity. all over the world in such tletech with friends from I could ever play Bat-There is no other way

matrix: at wholesomedonut colon matrix dot org mastodon: at wholesomedonut at fosstodon dot org external email: wholesomedonut at tuta dot io

6.3 Enter the Mech Man

Preface

learnt a great many things for this habitat and its inand have been inspired to habitants, and the smolcreate and wonder about net ecosystem at large, things I would not have that I present to you this otherwise. It is with pro- first issue of our smolzine,

tion of the Zaibatsu, I've found gratitude and pride Circumlunar Transmissions.

mieum APRIL 25, 2021 INCHEON, KOREA

dium takes away from the series played against To Be Fair the moment-by-moment me. Quoth my opponent: gameplay, forcing everybody to get ox-in-the- something out of Winmired over details that don't matter overall instead of letting their big cent version of the game. stompy robots blow each I hadn't touched it in a Java. And it's been a comother up.

Megamek works won-

ders in that regard. A game of Classic Battletech that could easily take 5 or 6 hours in person without any sort of calculator apps or an otherwise breakneck pace of gameplay and rules-lawyering will only take an hour or two maximum with Megamek. It's a godsend for a hobby that would otherwise be relegated to local play over predetermined days, not a "Hey want to play a match? Sure!" kind of casual pickup on a boring afternoon.

But It Isn't All Sunshine and Rainbows.

Nope! Megamek is, in my humble and donutshaped opinion, a terrible example of UI and UX. I played a round recently, and another aficionado of point.

"This program looks like dows 95." Neither of us had played the most revear at least.

Some changes were the decades. The fact welcome, and the development progresses smoothly. But it's still just as much a spaghetti plate in terms of user experience: configuration options laid out in long lists of check boxes organized by multiple topwindow tabs: a decidedly 15-vears-old design language that clashes with modern perceptions of UI and UX (which is bad considering that taking in new blood is crucial for both userbase and developer contribution reasons): and the final nail in the coffin is the fact that the much easier and more recent Alpha Strike ruleset isn't included at all by default, to my knowledge.

You might be able to con-

figure something like that

already putting the cart

The project started in 2000. It's 21 years old in some places, if only in logic and not literal syntax. It's written in munity effort by dozens of talented people over that it's alive at all is impressive, but so's the fact that the franchise whose boardgame it emulates even has a fanbase still. BT fans aren't guitters, certainly. And this is all considering the fact that trying to automate, obfuscate and de-FUBAR the mountain of minutiae that Battletech's rulesets and technical data (on a per unit and per variant basis no less) is a monumental task. I can hardly think of a video-game adaptation of a more complex board game that does a better job, in proportion to the complexity of the physical source material and gameplay flow. So considering it was

made in the waning days of Win98 (because Winusing plugins, but we're dows ME doesn't exist and you can't convince before the horse at that me otherwise) it's expected that it's ugly as

The Circumlunar Mixtape



THE Circumlunar Mixtape is an on- sloum's covid-year playlist

appear on any of his albums. recording of it and the recording doesn't live and this is my favorite performance is a Youtube link because I like this song each track except the Charlie Parr, which mix. I provided Bandcamp weblinks for a weird year and this is a kind of weird Some are old some are new. It has been various points throughout the last year. These are songs I have listened to at

Enjoy!

https://adriannelenker.bandcamp.com/track/forwards-beckon-rebound sbuos mort 0 ρλ γατίατης Lenker Forward Beckons Rebound

playlist curators may choose to supply it.

when a weblink to streaming is available

reader to locate them. As a courtesy,

so tracks are just listed and it is on the

or otherwise find and listen to music,

Y'all have all kinds of ways to stream

10 tracks they have been listening to.

missions where one user per issue shares

- Roing series for Circumlunar Trans-

rules proofing for you. single-action-attack-or-To alleviate the issue

their head: they're obflank. There are plenty of 9-MA2 ng nshw snsqqad newbie of the group what tenth time to show the G.A.T.O.R. card for the stead of reaching for your ever they may be, in-So you can enjoy the

puters. But asking some- name of combined-arms to. That kind of tethings that aren't com- ple even enjoy. All in the manually if I don't have

funneling through a sales mentality commercial than the plug-and-play game with others, whering. It's a bit more finicky ing others to FOSS gamand patience in introduc- math, calculations, and UX of FOSS gaming needs Therefore I urge empathy program does all of the tion too? I'm screwed. damage-roll-ever, this proper tools and educadepartment. Without the tional overhead for every-I'm doing anyway in that of significant calculalləd ədt tadw səbi on əvad light and a screwdriver. I 31st-century warfare. ticular kind of game, its' using nothing but a flash- detailed simulation of agnose a car's problems what realistic and highly is like asking ME to di- mor locations in a somelose that argument unless with cmake or whatever) nents, weapons and ar--oqmos linu going to bid build it themselves age to individual compothing, there is a solid code repo (or heaven for taking and giving dam-VYDam or some some some from a airplanes and infantry Epic or Microsoft Store or down the right version multi-ton robots, tanks, adding it on Steam or to figure out how to pull that involves groups of

Enter the Mech Man

ing, number-crunching this article. ing on 40 years of conniv- viously not the target of board game that's existed can do half the game in tletech rules, which is a know these rules well and sion of the Classic Bat- grognards out there who a fully computerized versustain itselt on a higher MegaMek. It's basically ready exposed on its' lett good and bad would be vehicle whose armor is algame that has plenty of missile spread hits a light A good example of a FOSS

skilled in a multitude of particular subset of peo- of doing all that stuff generally. They're very tomfoolery that only a I shiver at the thought

.tnerule than current. userbase is to grow and ent. That is, if the overall obtrusive and transpar--nu , sldsbnstandeble, unwith their friends needs load, to playing the game conversion or free down- systems have fostered. ot ,936q 6 no gnibnal mort this means all the way ern commercial offerings; to be on-par with modwalks of life; the UI and with people from many Suilgen't bne gnivrt to This comes from years socially-driven reason. content, or have a better interested in that parthey are very specifically secure) instead of just one who isn't tech savvy strategy on a hex board

Benefit of the Doubt since the 1980s and is go-Sive People the

People are intelligent,

6 Why I Still Game Proprietary

1 The Circumlunar Mixtape

Catamaran

by talons' 1 from Sonas for Boats https://talons.bandcamp.com/track/catamaran

Possessed by the Devil

by Charlie Parr 2 (Live) https://www.youtube.com/watch?v=P46hGYUycoE

Some Voices

by Pinback 3 from Some Voices https://pinback.bandcamp.com/track/some-voices

Get to Know You

by Tomo Nakayama 4 from Melonday https://tomomusic.bandcamp.com/track/get-to-know-you

Just a Cloud

by Lusine from Sensorimotor https://lusine.bandcamp.com/track/just-a-cloud-feat-vilja-larjosto

Good Morning Captain

by Slint 6

5

from Spiderland (Remastered) https://slint.bandcamp.com/track/good-morning-captain-remastered

Step Into You

by Hum from Inlet https://humband.bandcamp.com/track/step-into-you

Kingfisher

by Windhand from Grief's Infernal Flower https://windhand.bandcamp.com/track/kingfisher

2

8

Why I Still Game Proprietary

ionated reasoning.

Gemini and you can't do

that. I am certain you will

find peace through mea-

sured contemplation and

a cup of whatever warm

or cold liquid you enjoy.

by wholesomedonut

Proprietary Gaming Isn't All Bad

 $S_{\rm FOSS\, community,\,I\,see}^{\rm INCE\ getting\ into\ the}$ a lot of pushback towards the gaming industry as a whole. I can see why: DRM runs rampant, terrible business practices regularly conflagrate internet forums, anti-cheat programs are basically consensual (and mandatory for official online play in some cases) trojans, and to make it all worse it costs a mint to get into the hobby nowadays due to scalpers and crypto miners running rampant in the market.

I agree with all of those observations. They tire me. They concern me. They frustrate me daily.

However! There are Why Do I Use still reasons -not- to go Steam? the route of some I see

in the FOSS world and Well...everyone else that eschew gaming altoisn't a computer nerd usugether on anything but a ally does too. And the FOSS platform, with FOSS overhead for getting peogames, because...FOSS. ple of minimum techni-That argument is just as cal understanding (that dumb in practice, because like playing video games) it's an artificial limitainto FOSS gaming genertion that stands on someally is much more costly what subjective, opinin terms of mental and "But social capacity than the wholesomedonut, thou clout I usually have with angereth me!" I hear in my friends or family on the imaginary comments such matters. section because this is

King's English: If I have to instruct them to download the latest version of the game directly from Github in the Releases tab, or from some random website they've never heard of (even if it looks nice and is HTTPS

19

https://nilsfrahm.bandcamp.com/track/nue from Wintermusik 6 by Nils Frahm ənN

5 The Hearth of the Matter

Pid old Thomas Hobbes camera lenses (automatiten. We now only focus home are all but forgotlike the birth of a child for night. This is all that By analogy, sunrise is the deep dark of death's days lie before we slip into intimacy before separa- the bare bones of our final double, is a short space of who alone know where life and at its very end. bers, nurse the frail and

your breakfast over them too often, family mem-

coals left mostly, you cook far from one another that, lapse. When there are with striving and drift so have a point? wooden pyramid to col- of our lives so completely back away, waiting for the We fill the noon meridians cally). fire roars madly as you But, not so for the elderly. larger pieces of wood. The the case for the young. as the flames devour the macy is still most often hope builds and blossoms Such brief familial inti- day when hearth fires and As the kindling catches, whom the family cares. the world offers in this remark on the day ahead. ment on the cold, and you onto your hands and com- tion. and blow warm breaths wait too. You each rub body's heat while they go. This time, like its later the intimacy of strangers absorb a little of your as the others finish and Frequently, there is only close to you, hoping to dishes; they are piling up morning. Other's gather that it is his day to do the wash their bodies late in a fire on a cold winter's them ruefully remembers ipation for the warmth of with your fellows. One of others, not family memwhat it is to wait in antic- and share a joke or two of a loved one's life. Now on the horizon. I know ing coffee. You smile one another at the sunset hearth fire as it converges and drink your morn- bers no longer live near to

The Hearth of the Matter

by durtal

another child showing me a trick with a magnifying glass outside one sunny day. He quickly adjusted the glass's height over my forearm to effect a sharp pain as the converging rays burned a hole in my skin.

Hobbes brought 'focus' into broader English parlance nearly fifty years original. Focus is the later. I don't know if he Latin equivalent of the did this with a magni- Old English word 'hearth'. sun reminds me of a

T T SEEMS that Kepler fying glass or not. But, People still used the lat-I first used the Latin Hobbes is certainly not ter term in my youth, esword 'focus' in 1604 to my favourite philosopher. pecially in rural regions. refer to 'the point of con- With its particular take Phrases like "hearth and vergence' in the mathe- on human nature, he pub- home" and "keep the matical sphere. It is pos- lished Leviathan about home fires burning" catch sible that this is an ana- the same time he popu- something of its ethos. logical use of the term and larised a word whose use The hearth was where may reference the point is ubiquitous but whose household members gathof light created with a original meaning is too ered to cook or to work by lens. You probably know often unknown. Some- the hearthstone's firewhat I mean. I remember times the abstractions of light. In its warmth, chilscience and a specific sort dren sat to hear the stoof philosophy separate us ries of the family and from the mundane realicommunity after dusk. ties of life in unfortunate Kith and kin entertained themselves with music ways. Ironically, the political philosopher who es-

and drinking and dance nearby. In some cultures, families kept anpoused that humans are cestral bones beneath the "all take and little give" hearthstone. Here was a used a word that belied point of convergence in his contentions in the the human habitat.

The rising or setting

Ask Jone

W. asks:

What are some things I can do to help repair it? .retaia ym dtiw qidanoitaler beniarta a evad I

this for weeks: I come by scene. So I go to help him And so we go on like down on him. Pretty bad the cans come crashing falls over, and the rest of

other. Until one day I ing on the ground, and So we're both groan-

of Chunk'n'Dunk soup ting tires anyhow. I'm still dropping off cans that, but he keeps on get-falls on his head and he So to keep things going, want them. And he knows stack of cans. And some sharing is caring, right? more by then, so I don't cidentally knocks over the ber why at this point. But I'm not selling tires any And he gets so mad he acother, not that I remem- snow tires he found. But hates turkey-a-la-king. pretty pissed off at each leaves me another pair of yelling about how he patch where we were both every time I come by he he starts screaming and L and I went through this same lines as me, because other box of cans, and \mathbf{I} REMEMBER my dad dad's thinking along the go over there with an-

Not great. And I guess der and madder at each one from Chunk'n'Dunk? gradually getting madking. You ever try that and higher, and we're bad. after can of turkey-a-la- piling higher and higher know that hurts pretty Instead, I bring him can me. And all this stuff is turkey-a-la-king cans, you meatball-carrot stew one. tires outside his door for on a pile of Chunk'n'Dunk to bring his favorite, the stacks a few more snow And if you've ever fallen mad at him, I don't bother kitchen counter, and he hit the ground hard too. tritious. But because I'm of turkey-a-la-king on his a can on the floor, and stuff is just not very nu- and put like 5 more cans up, but I slip and trip on anymore. Although that he ever feels like eating for him, because it's all

2 Ask Jone

check it I find that co- times. incidentally the big pile of snow tires out there has ing to patch things up the meatball-carrot one. also fallen over, and it's with your sister, I would It's actually not bad. crushed some unlucky lit- say maybe don't do it with tle gnome who must have canned soup, or snow Thanks for writing in. I been milling around by tires. It sure didn't help hope that helps.

then there's this weird there. Those things are us any. It just wasn't a sound by the front door. so bad at staying alive, I good result for anyone, When I get out there to just can't believe it some- especially for that gnome. Or if you have to go with Anyways, if you're look- soup, at least stick with

Do you have a problem? Send your questions to:

_____ $| \rangle$ /1 ioneworlds / 1 $| \rangle$ $| \rangle$ Q / | \ mailbox.org / ____/ \ 1 1 ____/___________

discover that the SI sys- thing other than Earth's years before the caesium tem of units defined the rotation when it was es- definition was adopted. second based on some- tablished in 1960, seven

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4.7 References

4 What's the Deal with Leap Seconds

on a "one size fits all" time problematic, or giving up -sA .ycle of night and day. Aslinked with the natural

But Wait, There's

other exciting astronomic UTO, UT1 and UT2, meet the difference between цре мау уои сап learn -uì sldiszory and possible fuhighly recommend the ested to learn more, I If you're actually interdly and complicated, rest -pij kisselbeen needlessly fid-

uing to trade during the tion that the way we rep-

leap second. As soft- citation below), along the tuture holds for the ily find on the web (full It's far from clear what ture", which you can easconsensus on what to do article "The leap second: to be abolished. Plenty of over a tonne of details. calling for leap seconds assured I have skipped

like Ephemeris Time (ET),

in the tech industry are creasingly many voices It's no surprise that in- If you think this story trol has to stay up 24/7. hour, but Air Traffic Con- More! Stock Exchange for an shut down the New York option. It's one thing to second isn't always an scale. services off for every leap ply shutting time critical bad idea. Of course, sim- which is somehow less this was probably not a up with a new ugly hack outages around this time, two alternatives: coming and Twitter, experienced to do that, there are only zon, Instagram, Netflix suming we're not willing services, including Amaleap second. Given that resent time is intimately

instead. not to mention there's no with that idea, of course, beoble are very unhappy

erability situation at the 'uozizou' might be looming on the tirst negative leap second phase right now, so the ing through a bit of a fast the Earth's rotation is goa second is removed. And but will fail the first time worked correctly so far ware out there which has that there's plenty of softremovals, it's a safe bet insertions rather than need aven ateb of sbroose all. Because all the leap forget to do anything at Some systems, of course, non-smearing systems. ing errors compared to day of small, slowly vary-This just leads to a whole sudden discontinuities. problems associated with ods, like 24 hours, to avoid out over longer time peri-"smear" the leap second ing in :60). Other systems parse a timestamp endsome software will fail to a number of major web tamp 23:59:59 twice (since -səmit əht taşqar baştri

risk problems by contin- ing the millennia old no- restrial Time (TT), and UTC in 2016, rather than entirely means abandon- GPS Time (GPST) and Terhour around midnight -nulov ot besige volunmajor stock exchanges bad enough that several time of a leap second is The software interop-

₽ī

ting rid of leap seconds tarily shut down for an and that means that get- and atomic time scales any time soon, though, ond likely isn't going away atomic definition of seclikely to get worse. The seconds cause are only ever they take you. Along world, the headaches leap ing Wikipedia links wherware continues to eat the with, as always, follow-

augoloabl Manifesto of a Granular

by tfurrows

Impractical Idealist Passing Thoughts of an

and type, bits and clouds. brought clay tablets and papyrus, script Then they learned permanence; epochs First they cast in words, ephemeral. ideas into the inexhaustible current. O of the Euphrates and cast their O

century, but the notion dates to our earword manifesto dates to the fourteenth elastic mind seized and crumbled. The waters slowed, intelligence waned, the a consummate standard. Life-giving sew dass it as ni besset to maj Permanence dammed the river, a log-

fear nothing Take something from every ideology,

Find kernels of truth and germinate

Accept that knowledge is scattered

Let your mind move freely, become a

fo mad sht qotA gaittie

From a Message in a Bottle,

of making the problem worse, I proffer:

ativity, passion, and progress. At the risk

of manifestos that stop the flow of cre-

proadly

seeker

Manifestos

Subscribe to that which you find value

for dealing with the mountainous dam that few will find. It is a loose model manifestos. It is a message in a bottle This is not the manifesto to end all

liest written conclusions. styguodt

3 Manifesto of a Granular Ideologue

Mistrust labels, they carry unimaginable baggage

Acknowledge all that came before, but accept the utility of your journey

Never believe that you have the best vision for the world

Don't try to fashion the world to your ideals; your ideals are cursory

Find. purify, share, repeat

Be a maximal minimalist, distill purity

from immensity

To conclude means to cease to grow

tfurrows@circumlunar.space tfurrows@sdf.org

allowed when necessary are inserted or deleted ogy it relies on), removing of the sun across the sky.

applied before leap seconds were established in 1972. All of them to date have been insertions regular, predictable basis, like leap years (which simple. are an adjustment for the fact that the time it takes the Earth to orbit the sun once, defining a year, is not perfectly divisible by

the time it takes the Earth to rotate once, defining a day). Because the Earth's rate of rotation fluctuates randomly, sometimes slowing down and sometimes speeding up, asor December 31st, and simplicity of the technol- tamp 23:59:60, but others

to keep the time scale at midnight UTC (which some of the argument for locked to the movement is the middle of the day in some time zones, of lock step with the Earth's So far, there have been course) on those days. rotation. At the same 27 leap seconds defined, At the time of writing, the time, the internet has although UTC and ATI are last leap second happened today exactly 37 seconds on December 31st, 2016. apart - the other 10 sec- In principle, six months is onds come from hacks enough advance warning that nobody doing anything which depends on precise time synchronisation should be caught rather than removals. by surprise when a leap They don't happen on a second rolls around. In practice, it's not always so

Increasing Implementation Burden and an Uncertain Future

Leap seconds have always had their critics, but at the time they were adopted, their benefits arguably balanced their astronomers need to be ac- sociated hassle. 50 years differently from another tively on the lookout for later, this hack is starting excessive values of DUT. to show its age. The ad-When it's decided a leap vent of cheap and reliable second is needed - it's the GPS technology means IERS who makes that call that celestial navigation - they are announced at at sea is now rarely a matleast six months in ad- ter of life or death (alvance. They're allowed to though some sailors still tems represent the extra occur on either June 30th appreciate the relative second using the times-

making sure UTC stays in

4.5 Implementation Burden

come along: a massive network of computers talking to each other, with the frequent need for activity on one to be synchronised with activity on another (hence tools like the Network Time Protocol, NTP). Computer programmers hate leap seconds, for the same reason they hate Daylight Saving Time: they complicate time calculations (vou can't accurately calculate the number of seconds between two UTC timestamps without consulting a table of when previous leap seconds were inserted) and are a frequent cause of confusion and errors, when one system implements them its trying to interoperate with.

Affordances for leap seconds are often added to software as an afterthought - if they are added at all. Some sys-

Timescales Seconds? A Brief Overview of What's the Deal with Leap

on my own characteris-

accurate overview based

plete, possibly slightly in-

instead: a brief, incom- hours in a day, a second

ph solderpurk

spuoses Astronomical

the Earth to complete a day in certain contexts. day as long as it is?" - nomically defined time the answer to "why is a way to do it. This astrothe day. Everybody knows plications, it's the best fined implicitly by that of fine time - for some ap--eb of yew eldisnes to de-Well, no. This is a perstory, right? out of the full 360. End of tate one 240th of a degree, it takes for the Earth to ro-

like, a second is the time

to rotate once. Or, if you

the time it takes the Earth

to At004,08 and ylqmis si

you're stuck reading this, minutes in an hour and 24 (technically, there are a axis. And since there are modern incarnation is

Bell". But he didn't, so 60 seconds in a minute, 60 Universal Time, or UT osM to mobgniX sht ni" Earth, Mother Board" or single revolution about its The official name of its the spirit of his "Mother Wired article about, in one day is the time it takes scale is still in use tocably compelling 1990s -ilqxani, gnol yllsaiqa ns. Stephenson had written thing that I wish Neal -əb nəəd zah dişnəl zi rabbit hole. It's some-'punoze uaad sed broud, and delightfully twisted that the concept of the qeab a nwob sbasi doinw For most of the time ingly simple question longer? This is a seemweek or so. a little shorter or a little on the topic over the past W HY is a second as ton hor for $\sin it$ is, and not tically obsessive reading

> irregular. rotation is unpredictably ning globe whose rate of chronisation with a spin-The abbreviation UTC incompatible properties able but fundamentally

scale where the number ther inserting or removdirection, UTC is kicked ference is on track to extime it looks like that dit-6 - TU bns DTU nsewted 1972, the ugly hack of 50 years now, starting in -9mos b9gnah3 2amethe ugly hack underlying The precise nature of

mise time scale between itself is a strange compro-OTU szussed, gnittif tahw ordonné"). This is some--oO lasravinU sqmaT" rof) SUT noitaiverde danari breviation CUT and the between the English ab- regular seconds, and synis a strange compromise of a timescale: perfectly people have heard off last, something normal to reconcile two desirrersal Time, or UTC - at is a stubborn attempt celestial navigation would Enter Coordinated Uni- any other way, as UTC make everybody happy. ugly hacks. It cannot be

attempt to achieve the achieved, like all techni- seconds in a UTC day, but This synchronisation is most always are 86,400 go by IERS) definited yet for safe ocean passage. by definition. There alwith sufficient accuracy absolutely fixed at 86,400 form celestial navigation of seconds in a day is not allows seafarers to perenough with UT that it makes UTC the only time kept synchronised closely one particular day. This and astronomers, UTC is ing a single second on to the chagrin of sailors turther away from UT, back into alignment by eiis destined to drift ever cisely. But whereas TAI ceed 0.9 seconds, in either and frequencies very preinstruments and reliably carefully monitored. Any the French "Bureau In- world to calibrate their quantity denoted DUT is and engineers around the atoms, allowing scientists is this. The difference ond based on caesium second. The way it works using the SI standard sec- choice has been the leap actly as long as any other, Every second of UTC is exis an atomic time scale. defined, but for almost UT and TAI. Like TAI, UTC what since it was first

·\lood improvement for everyscale wasn't actually an and improved" TAI time Wan" and that the sint the Earth and the stars. further out of synch with accurate as TAI drifted become increasingly less ,TU fo bastani IAT gnitea

Coordinating Chaos

best of both worlds and cal compromises, using 86,401 and 86,399 are also another time scale, in an version of their name and to abbreviate the English Service, who have the gall national Earth Rotation Mesures" and the Inter-International des Poids et for the French "Bureau and Measures, or BIPM, tional Bureau of Weights bination of the Interna--moo a ot bassed need but today the torch has measure time intervals ternational de l'Heure", Time Bureau, or BIH, for that was the International powers that be (back then January 1st in 1960 the ily lead to confusion, on -see bluos daird easnals for different purtwo different time sig-Instead of broadcasting

few subtly different vari- less. In fact, even though have. For most of the ants, denoted UT0, UT1 the overall trend is one time this definition was and UT2, but we'll gloss of slowing down, some used, the fluctuations over that here). The offi- years the rotation actu- were smaller than we cial determination of UT ally speeds up. The dy- could reliably measure. nowadays is based mostly namics of the process are Certainly, they weren't on measurements made complicated, and we can't enough to have an imat observatories tracking make accurate long term pact on everyday life. Nothe movement of distant forecasts. Gravitational radio sources across the interaction between the to lunch because of the sky as the Earth rotates. Earth and the moon is Earth's unsteady rotation. This is easier than mak- the primary driver, but But by the 20th century, ing precision measure- the movement of tec- scientific and technologiments of the sun, but is tonic plates and friction cal progress meant these still measuring the exact between Earth's surface tiny fluctuations started same thing.

Earth is a Nice Place to Live, but it's not the Best Clock

tronomical definition of the second is this: the tion that we just don't un- onds! Gigahertz radia-Earth doesn't actually rotate at a perfectly con- But the take home mes- in radio astronomy and stant rate (it wasn't until the 19th century that we could build clocks accurate enough to notice random fluctuations in came to underpin modthis). In fact, the Earth's their duration over long rotation is slowing down. time spans. If you define WiFi, and mobile data net-Very slowly, of course. the second by looking into Every century, a complete the skies, no two seconds sured in *picoseconds*. Even rotation takes about 2 milliseconds longer than it used to. The rate of slow- venient property for the are enough to make the ing down is not steady. official definition of a fun-measured frequency of Some years the change is damentally important radio waves change, even more and other years it's unit like the second to if the actual frequency

erful enough to shorten the length of a day by The problem with an as- are even periodic variations in the rate of rotaare exactly the same.

and its atmosphere and to matter, as we began oceans have their say, too, measuring natural phe-The Indian Ocean Earth- nomena and building maguake in 2004 was pow- chines which operated on very small time scales. A 10 megahertz radio oscil-2.68 microseconds. There lator, for example, has a period of 0.0000001 seconds - only 100 nanosecderstand the cause of yet. tion, which is important sage is that, whatever the was used for communicauses, astronomical sec- cations and radar during onds actually have small. WWII decades before it ern technology like GPS, works, has periods meavery, very small variations That's a pretty incon- in the length of a second

body was going to be late

is fixed. Modern tech- quency which, as far as will always be high in the nological society simply we can tell, is completely sky. This is true today and couldn't be built using and perfectly stable, and a wobbly clock like the which can be measured Earth.

Atomic Seconds

atomic clocks were invented which kept time better than any previous mechanism. I'll gloss right over the details, but suffice it to say, we came midnight on January 1st up with a new way to define the second which perfectly synchronised. involved measuring the Ever since then, they have properties of caesium slowly but surely drifted atoms instead of looking at things moving through the sky. In 1967, the relatively young In- by averaging hundreds of units redefined the sec- Earth's rotation. The acond on this basis. The new cumulated drift up until atomic second was defined such that it had the seconds, but it will connomical second in use be- limit. And while the pertell, but it had the added tool for some tasks, this bonus that the length of drift apart from UT makes the second was then fixed it problematic for others. and unchanging. Caesium If you go outside at noon atoms at a given temperature "vibrate" (very (or anywhere else at 0 deloosely speaking) at a fre- grees longitude), the sun signals switched to broad-

very accurately in a sufficiently advanced laboratory.

With the arrival of damentally divorced from Fortunately, in the 1950s, atomic seconds, a new it. Thousands of years time scale was also defined: International Atomic Time (or TAL for the French "Temps Atomique International"). At in 1958. TAI and UT were apart. The seconds of TAI are of perfectly unchanging length (as measured ternational System (or atomic clocks all over the tain time and consulting SI, for the French "Sys- world), but the seconds a printed table of convertème International") of of UT fluctuate with the sions. For this purpose, now is a little less than 40 same length as the astro- tinue to grow, without true UT time using time fore it, as far as measure- fectly uniform seconds of dio stations all over the ments at the time could TAI make it the perfect world. Celestial naviga-UT in Greenwich, England

it will be true in a thousand years, Because UT is fundamentally linked to the Earth's rotation. TAI, on the other hand, is funin the future, there will come a day when, according to TAI, the sun rises in Greenwich at midnight.

This isn't just an abstract concern for the distant future. In the late '50s when TAI was defined, it was still common for ships at sea to figure out where they were by using a sextant to record the position of the sun above the horizon at a cerships carried the most accurate clocks they could afford, and compared them regularly against signals broadcast by ration works very well when using a timescale which is tightly linked to Earth's rotation, and hence the position of things in the sky. But if the radio time