Internet auf See?
Cybersecurity auf Schiffen

(Ein)Blick in die Maritime IT

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Ihr Ansprechpartner

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Internet auf See?

(Ein)Blick in die Maritime IT

Und was das mit Security zu tun hat.

Stephan Gerling

OT Cyber Security Consultant

admeritia GmbH

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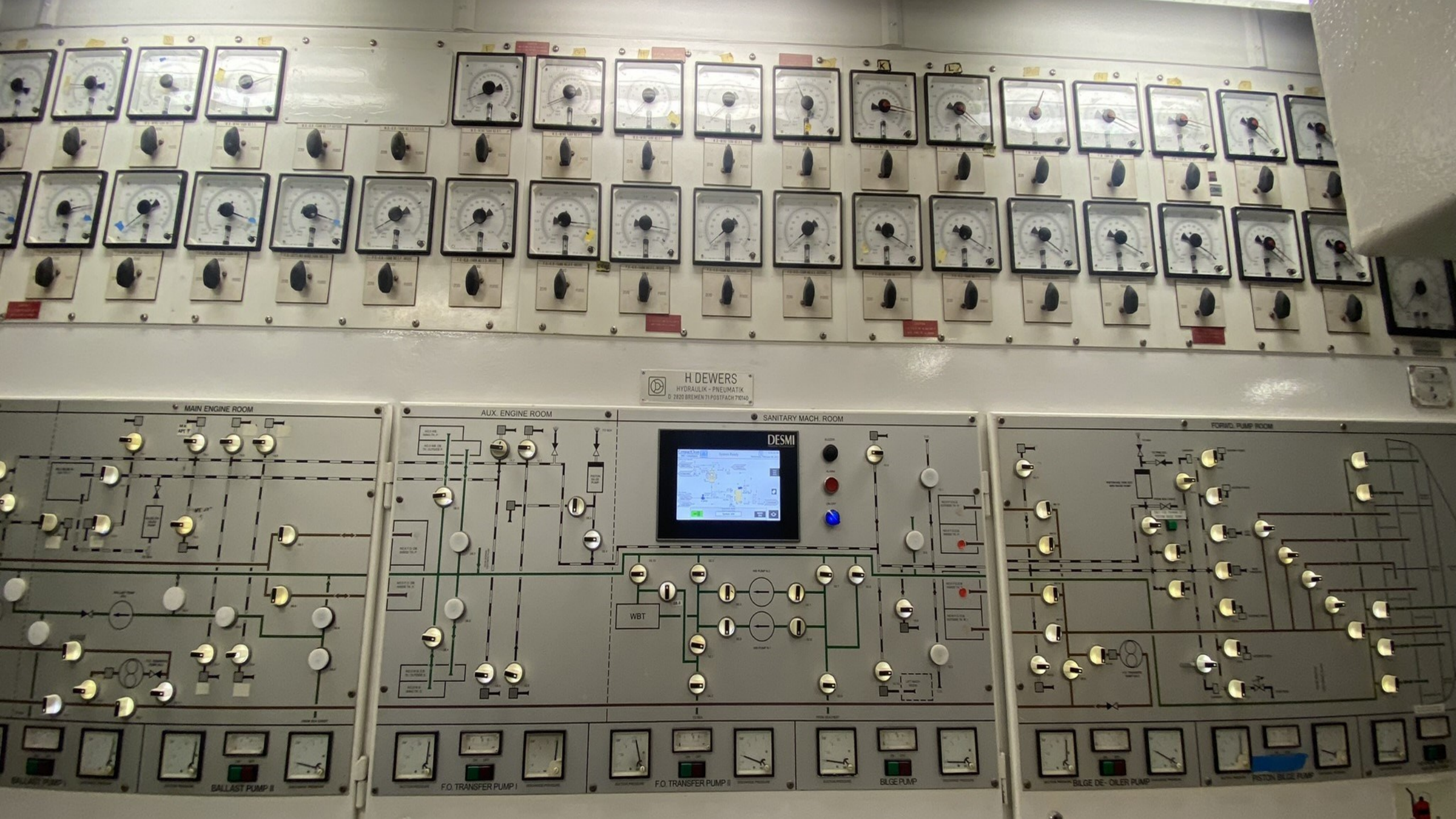
@ObiWan666


H. DEWERS
HYDRAULIK – PNEUMATIK
D 2820 BREMEN 71 POSTFACH 710140
MAIN ENGINE ROOM
AUX. ENGINE ROOM
SANITARY MACH. ROOM
FORW'D. PUMP ROOM
DESMI
WBT
BALLAST PUMP II
F.O. TRANSFER PUMP I
F.O. TRANSFER PUMP II
BILGE PUMP
BILGE DE - OILER PUMP
PISTON BILGE PUMP

Ich liebe meinen Job

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Maritim	Radar – AIS – GPS – ECDIS – etc.
IT	Crew – Gäste - Owner – Office-IT Entertainment (Audio-Video)
OT	Antrieb – Steuerung – Energie – Stabilizer – Spezial Equipment

erster Überblick

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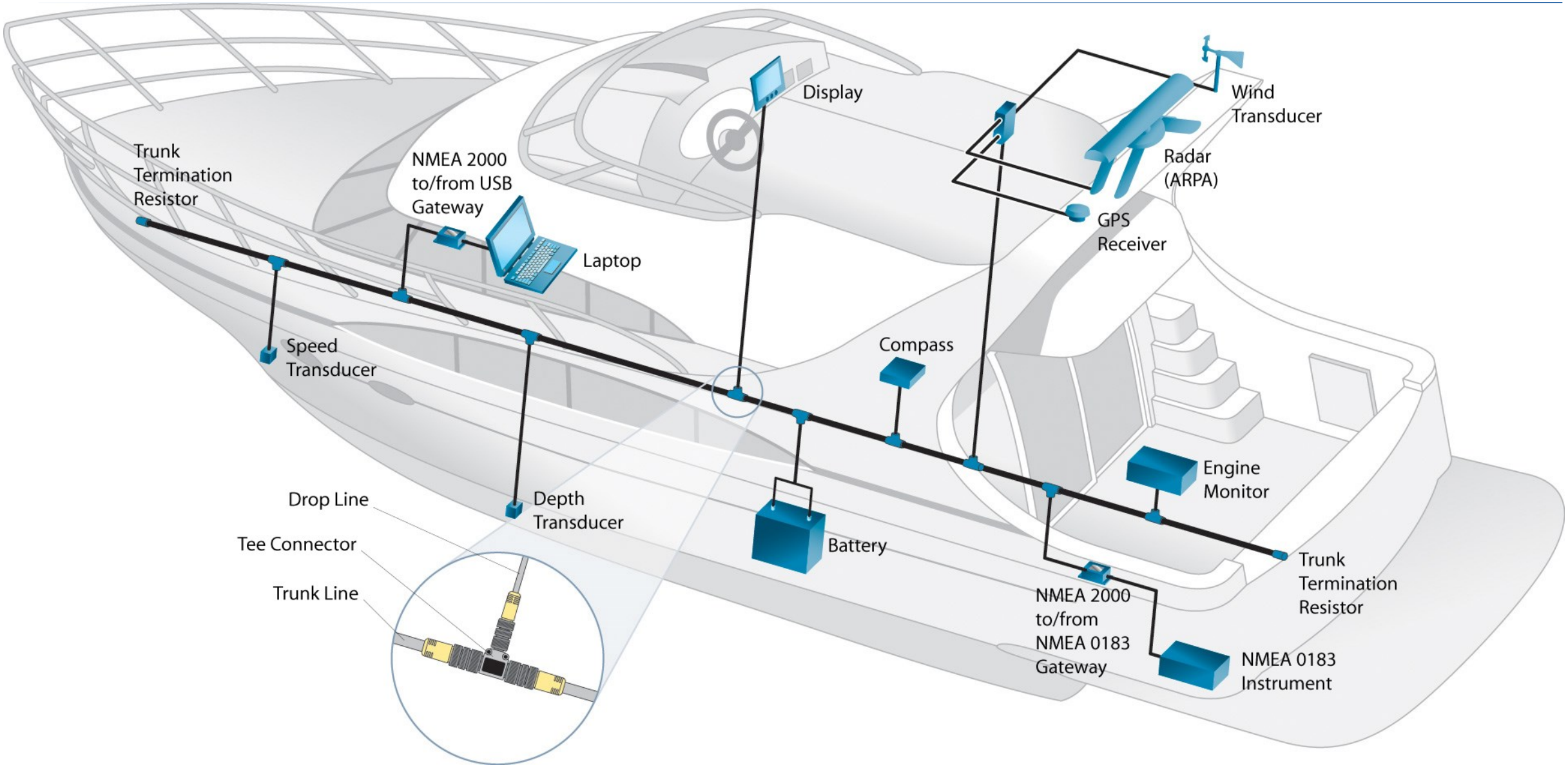

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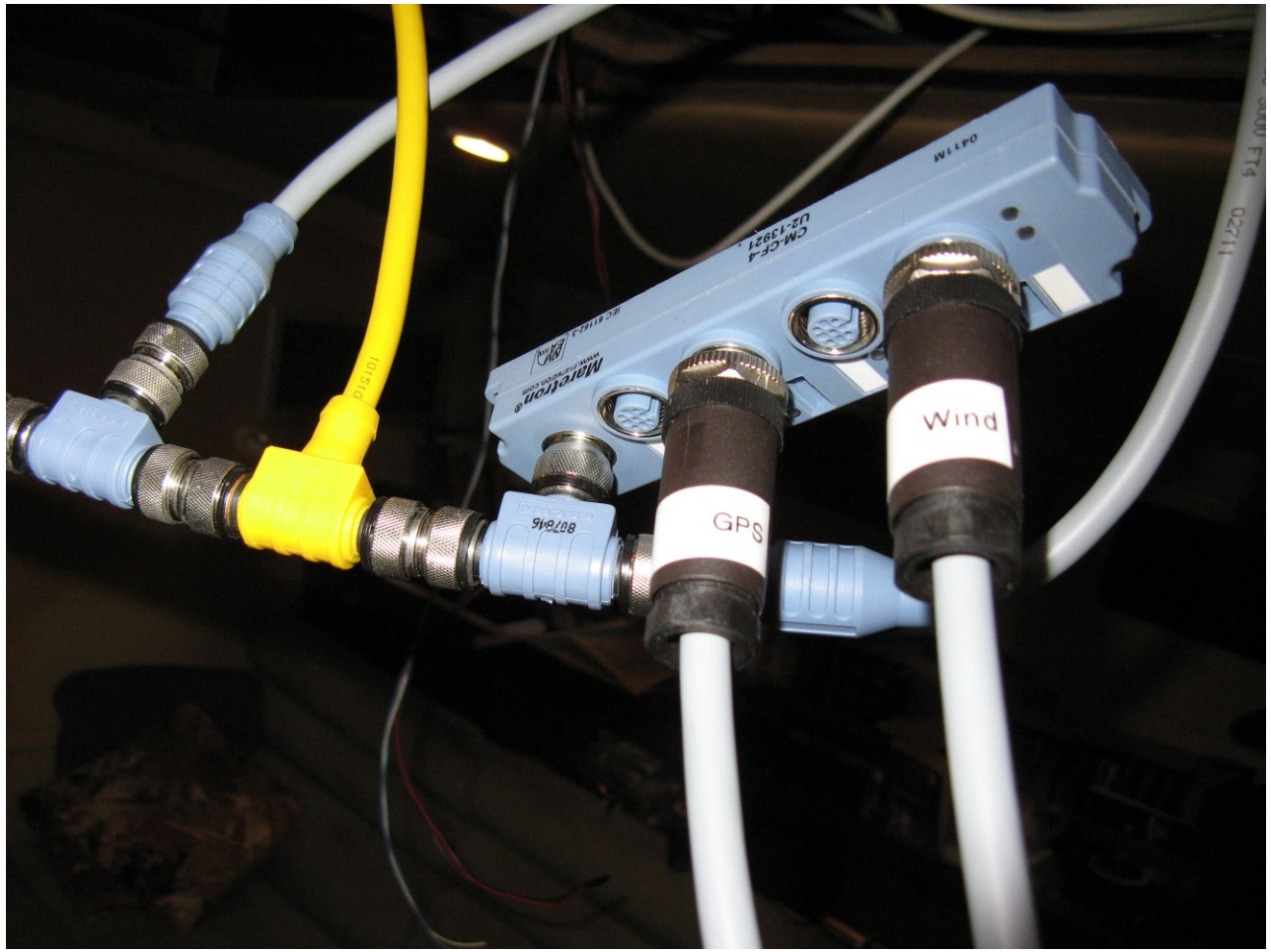
Verkabelung

- NMEA 0183 - seriell
- NMEA 2000 – SAE J1939

Farbe	Name	Spannung	Funktion
weiß	CAN-High	+ 2,5V	Signal
blau	CAN-low	- 2,5V	Signal
metallisch	-		Abschirmung
rot	V+	+ 12V	Spannungsversorgung
schwarz	V-	0V	Spannungsversorgung



Satcom

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Satcom

- Offshore internet via SATCOM
- Problem Patching?
- Viele “vulnerable” Geräte immer noch Online
- Wird vermehrt durch STARLINK ersetzt
- WiFi to shore bis >15NM möglich

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Online suche auf Shodan.io

- “Sailor 900”
- “Inmarsat Solutions”
- “Telenor Satellite”
- “Commbox”
- org:"Intelsat GlobalConnex Solutions (GXS)“
- org:"Telenor UK Ltd"

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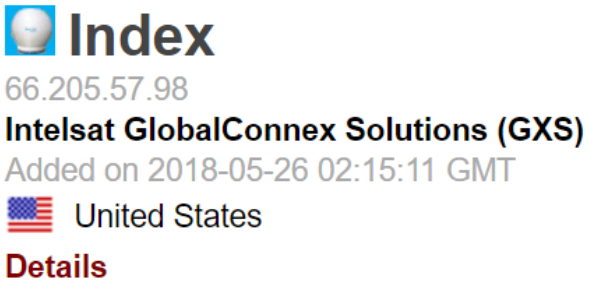
Oh, was hab ich den hier?

“stabilized Digital Antenna System”




```
HTTP/1.1 200 OK
Server: Micro Digital Web Server
Connection: close
Expires: 0
Cache-Control: must-revalidate = no-cache
Last-Modified: 0
Content-Type: text/html
Content-Length: 574
```

- “Cobham Seatel MXP Webserver”
- Optimierter Suchbegriff: “Server: Micro Digital Webserver”

Search “Server: Micro Digital Webserver”

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Shodan | Developers | Book | View All...

SHODAN | Server: Micro Digital Web Server | Explore | Downloads | Reports | Developer Pricing | En

Exploits | Maps | Share Search | Download Results | Create Report

TOTAL RESULTS

21

TOP COUNTRIES

United States	8
Brazil	5
Italy	2
United Kingdom	2
Singapore	1

TOP SERVICES

HTTP	17
HTTP (8080)	3
HTTPS	1

TOP ORGANIZATIONS

Index

66.205.57.98
Intelsat GlobalConnex Solutions (GXS)
Added on 2018-05-26 02:15:11 GMT
United States
Details

```
HTTP/1.1 200 OK
Server: Micro Digital Web Server
Connection: close
Expires: 0
Cache-Control: must-revalidate = no-cache
Last-Modified: 0
Content-Type: text/html
Content-Length: 574
```

Index

217.173.54.10
Telenor UK Ltd
Added on 2018-05-26 00:24:52 GMT
United Kingdom
Details

```
HTTP/1.1 200 OK
Server: Micro Digital Web Server
Connection: close
Expires: 0
Cache-Control: must-revalidate = no-cache
Last-Modified: 0
Content-Type: text/html
Content-Length: 574
```

Index

Frage:

Was sind die wichtigsten Tools eines Angreifers?

Antwort:

- Benutzerhandbuch
- F12 oder “view source” im Browser

RTFM

Im Handbuch steht:”username” & “password”

- Dealer: seatel3
- SysAdmin: seatel2
- User: seatel1

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Login Seite mit F12 oder “view source” anschauen:

/js/userLogin.js

```
if(t=="Dealer"){if(r=="true"){e="MenuDealerGx.html"}else{e="MenuDealer.html"}}else
if(t=="SysAdmin"){if(r=="true"){e="MenuSysGx.html"}else{e="MenuSys.html"}}else
if(t=="User"){if(r=="true"){e="MenuEuNCGx.html"}else{e="MenuEuNC.html"}}
```

SatCom

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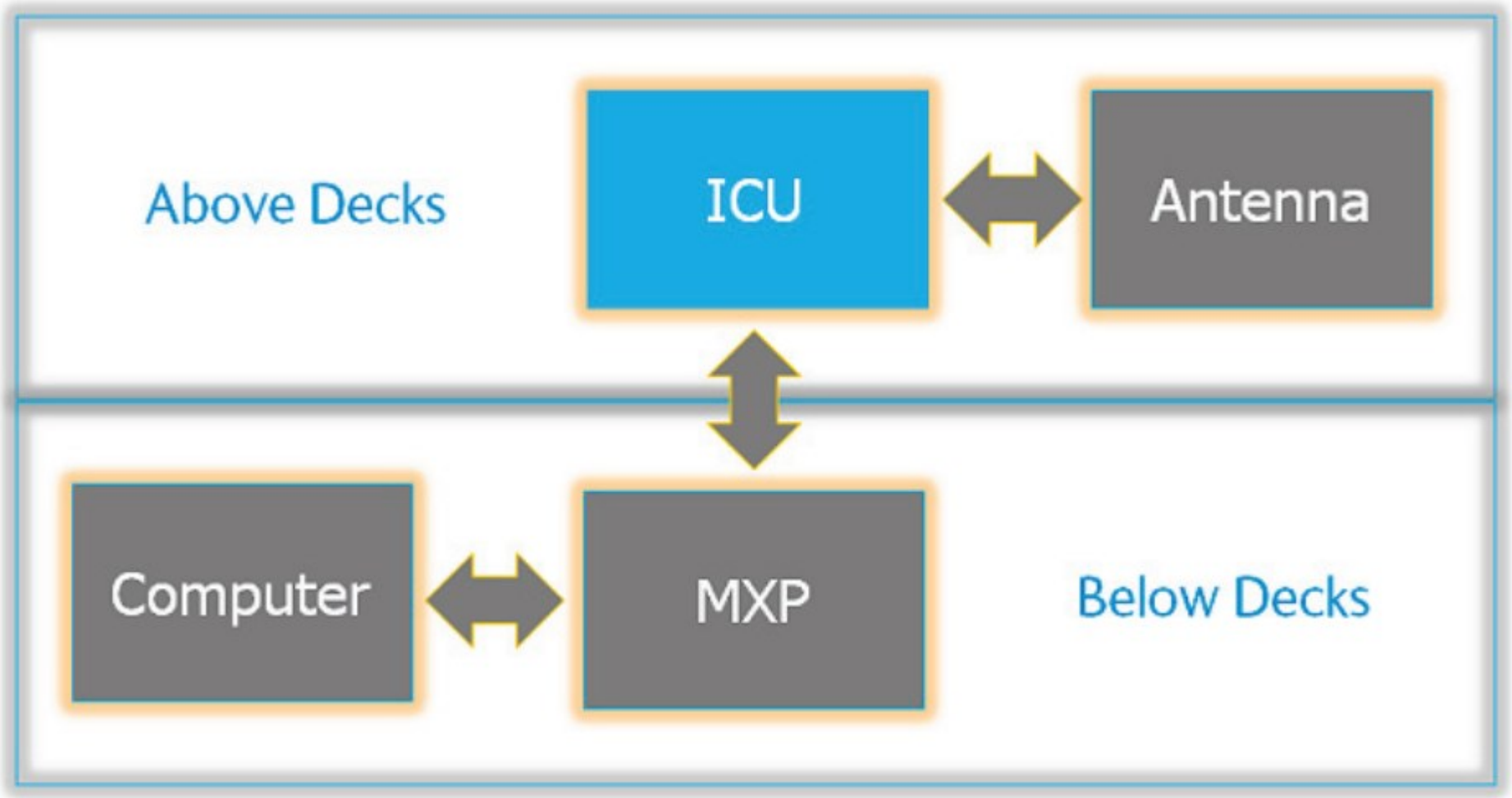

Cobham Seatel Satcom

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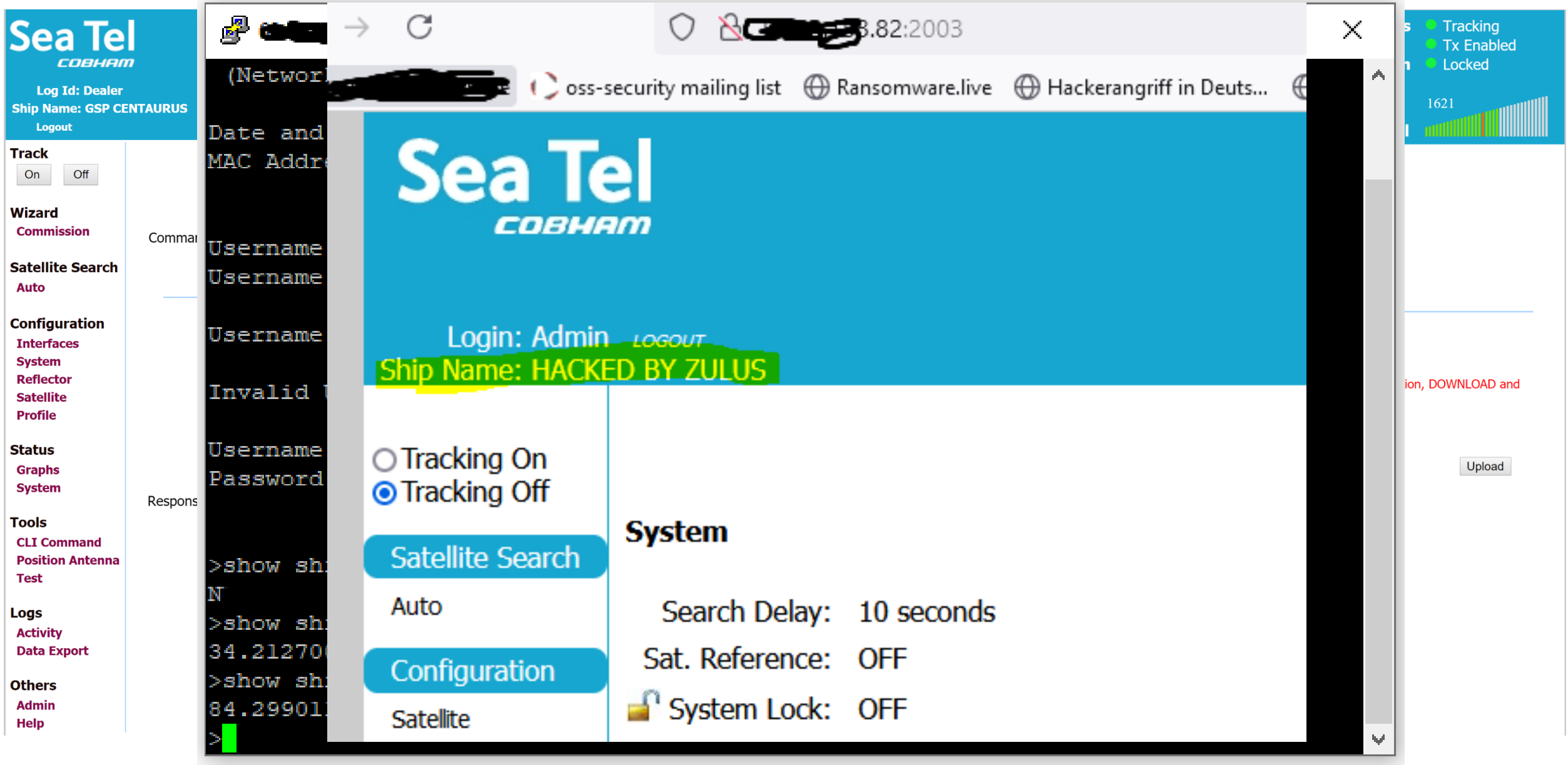

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CVE-2018-16114
- Auth bypass in Cobham Seatel
Patch verfügbar

“Cobham_seatel_inifile-dump.py”
auf meinem Github verfügbar:
https://github.com/ObiWan666/maritime

```
[SATELLITE_FAV:0]
DESCRIPTION = INOVSAT
LON = 22.0 W
FREQ = 1328.737
SKEW = 0.0
BAND = 2
TX_POL = V
SEARCH_PATTERN = SPIRAL
REFLECTOR = PRIMARY_REFLECTOR
LNB = XPOL
# ****************ICU1 INI************
# ************************************
# IMPORTANT: DO NOT MODIFY THIS SECTION
[REVISION]
INI_MAJOR = 1
INI_MINOR = 2
INI_TIMESTAMP = 2675566445
# ************************************

[HARDWARE]
TYPE = ICU

[VERSION]
MXP = 179 (Build:224945)
MXP_BUILD_DATE = Dec 15 2017, 11:03:06
ICU = 179 (Build:224945)
ICU_BUILD_DATE = Dec 15 2017, 11:03:06
MDB_RUNNING = 2.07
```

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Locomarine Yachtrouter

- High power WIFI Booster for long distance connectivity (15+ NM)
- High power 4G/3G/2G module (30+ Nautical miles)

The control software (PC/Android/iOS)

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The control software

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- App nutzt FTP
- Download “YachtRouterGen3.xml
- Änderungen in dieser XML
- FTP upload
- Hardcoded credentials!!!
- WLAN SSID und Password in XML

344	98.416854	10.80.0.1	10.81.255.254	FTP	109	Response: 220 YachtRouterMiniB FTP server (MikroTik 6.24) ready
345	98.418233	10.81.255.254	10.80.0.1	FTP	65	Request: USER loco
346	98.418601	10.80.0.1	10.81.255.254	TCP	60	21→21418 [ACK] Seq=56 Ack=12 Win=14600 Len=0
347	98.418976	10.80.0.1	10.81.255.254	FTP	86	Response: 331 Password required for loco
348	98.419067	10.81.255.254	10.80.0.1	FTP	81	Request: PASS SecureConnectingUser
349	98.451857	10.80.0.1	10.81.255.254	TCP	60	21→21418 [ACK] Seq=88 Ack=39 Win=14600 Len=0

Firmware enthält Passwort

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```
static yrEngine()
{
  yrEngine.RouterConfig_Username = "loco";
  yrEngine.RouterConfig_Password = "SecureConnectingUser";
  yrEngine.RouterConfig_FtpPath = "ftp://10.80.0.1/YachtRouterGen3.xml";
  yrEngine.RouterSupportInfo_FtpPath = "ftp://10.80.0.1/SupportInfo.png";
  yrEngine.extenderIdentity = "YR_WIFI_EXTENDER";
  yrEngine.rootExtenderDHCPServer = "dhcpBACKBONE";
  yrEngine.bridgePrefix = "bridgeEoip_";
  yrEngine.routingMarkPrefix = "markAlwaysON_";
  yrEngine.virtualApPrefix = "wifiAlwaysON_";
  yrEngine.virtualApSecurityProfilePrefix = "SecurityProfile_";
  yrEngine.eoipTunnelPrefix = "eoipTunnel_";
  yrEngine.shipPhysicalWifiInterface = "shipPhysical";
  yrEngine.defaultPassword = "12345678";
  yrEngine.rootIpAddress = "10.90.";
```

Und es kommt noch schlimmer!

NMAP scan on the puplic IP

- Router os= Mikrotik Router OS
- Winbox Management 8291/TCP
- API access of the Yachtrouter exe 8728/TCP (API)

- Portscan from Internet:
- PORT STATE SERVICE
- 21/tcp open ftp
- 22/tcp open ssh
- 53/tcp open domain
- 2000/tcp open cisco-sccp
- 8291/tcp open unknown

Remote support

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Yacht Router model & serial nun

How do they know the IP addres

```
or=0
..!done../ping.=address=5.10.88.130.=count=5..!r
et-loss=100..!re.=seq=1.=status=no route to hos
 host.=sent=3.=received=0.=packet-loss=100..!re.
```

Whois IP 5.10.88.130

```
% This is the RIPE Database query service.
% The objects are in RPSL format.
%
% The RIPE Database is subject to Terms and Conditions.
% See http://www.ripe.net/db/support/db-terms-conditions.pdf

% Note: this output has been filtered.
%       To receive output for a database update, use the "-B" fla

% Information related to '5.10.88.128 - 5.10.88.135'

% Abuse contact for '5.10.88.128 - 5.10.88.135' is 'abuse@softlay

inetnum:        5.10.88.128 - 5.10.88.135
netname:        NETBLK-SOFTLAYER-RIPE-CUST-BO1663-RIPE
descr:          LOCOMARINE DOO
country:        HR
admin-c:        BO1663-RIPE
tech-c:         BO1663-RIPE
status:         ASSIGNED PA
mnt-by:         MAINT-SOFTLAYER-RIPE
created:        2013-07-25T18:27:47Z
last-modified:  2013-07-25T18:27:47Z
source:         RIPE
```

Issue #4 – Winbox Management

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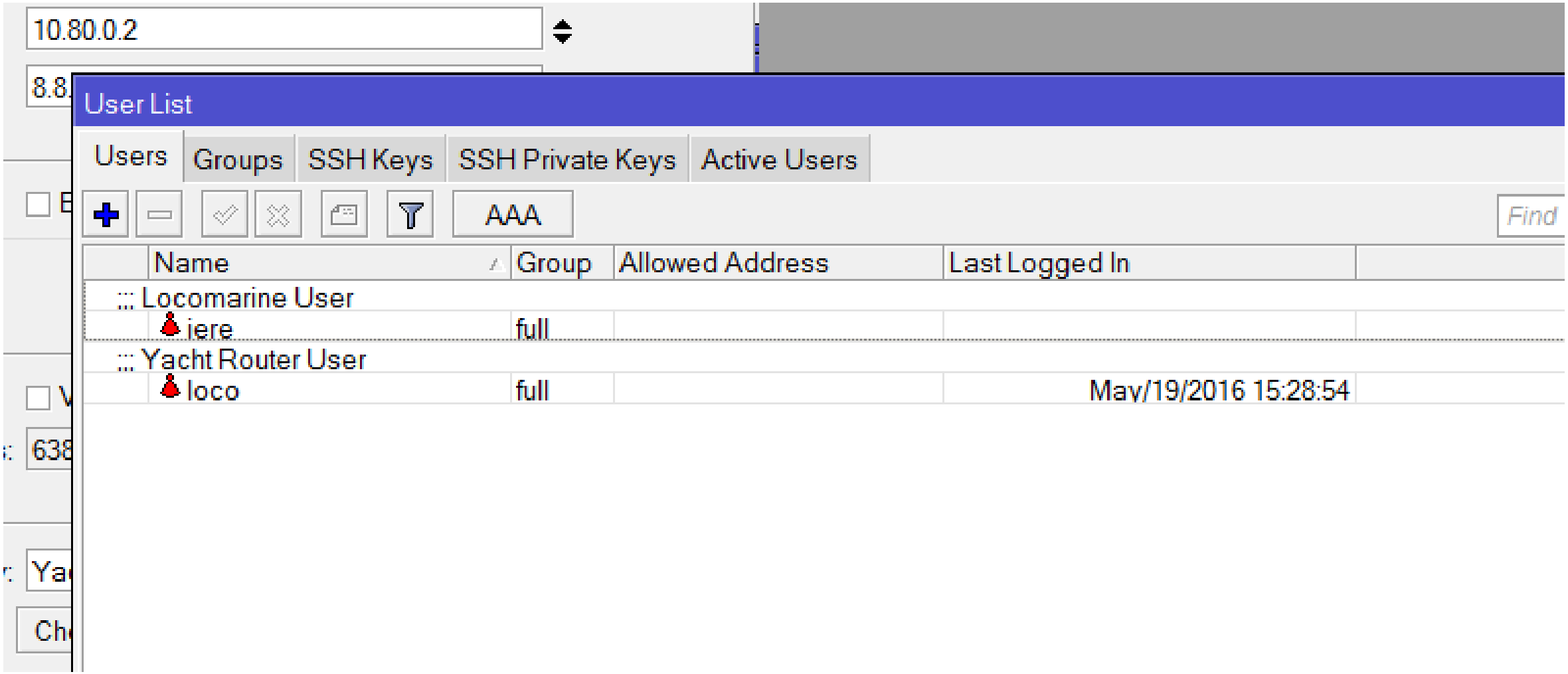

Issue #4 – Winbox Management Cracking

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MKBRUTUS v1.0.0

Password bruteforcer for MikroTik devices or boxes running RouterOS
Site: https://github.com/mkbrutusproject/MKBRUTUS

Or use CVE-2018-14847 (works on Mikrotik 6.42 or below)
https://github.com/BigNerd95/WinboxExploit

$ python3 WinboxExploit.py 192.168.0.1

- User: the user
- Pass: StrengGeheim

Vendor response

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- Security issues reported in June 2017 to vendor
- 2 bugs intensely fixed
- New Apps and router firmware versions were developed
- In November finaly released
- Permission from vendor to present
- CVE-2017-17673 requested

http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2017-17673

Hersteller Patch

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- Hersteller hat die Lücken geschlossen

Und was genau wurde gemacht?

- .Net application ist nun obfuskiert
- FTP wurde durch SSH ersetzt

WTF - Security by obscurity – wirklich?

Obfuscated code

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```
ICSharpCode.Decompiler.DecompilerException: Error decompiling System.String YR.Core.yrEngine/MyUserInfo::getPassword()
 ---> System.NullReferenceException: Object reference not set to an instance of an object.
   at ICSharpCode.Decompiler.CecilExtensions.GetPopDelta(Instruction instruction, MethodDefinition methodDef)
   at ICSharpCode.Decompiler.ILAst.ILAstBuilder.StackAnalysis(MethodDefinition methodDef)
   at ICSharpCode.Decompiler.ILAst.ILAstBuilder.Build(MethodDefinition methodDef, Boolean optimize, DecompilerContext context)
   at ICSharpCode.Decompiler.Ast.AstMethodBodyBuilder.CreateMethodBody(IEnumerable`1 parameters)
   at ICSharpCode.Decompiler.Ast.AstMethodBodyBuilder.CreateMethodBody(MethodDefinition methodDef, DecompilerContext context, IEnumera
   --- End of inner exception stack trace ---
   at ICSharpCode.Decompiler.Ast.AstMethodBodyBuilder.CreateMethodBody(MethodDefinition methodDef, DecompilerContext context, IEnumera
   at ICSharpCode.Decompiler.Ast.AstBuilder.CreateMethod(MethodDefinition methodDef)
   at ICSharpCode.Decompiler.Ast.AstBuilder.AddTypeMembers(TypeDeclaration astType, TypeDefinition typeDef)
   at ICSharpCode.Decompiler.Ast.AstBuilder.CreateType(TypeDefinition typeDef)
   at ICSharpCode.Decompiler.Ast.AstBuilder.AddTypeMembers(TypeDeclaration astType, TypeDefinition typeDef)
   at ICSharpCode.Decompiler.Ast.AstBuilder.CreateType(TypeDefinition typeDef)
   at ICSharpCode.Decompiler.Ast.AstBuilder.AddType(TypeDefinition typeDef)
   at ICSharpCode.ILSpy.CSharpLanguage.DecompileType(TypeDefinition type, ITextOutput output, DecompilationOptions options)
   at ICSharpCode.ILSpy.TextView.DecompilerTextView.DecompileNodes(DecompilationContext context, ITextOutput textOutput)
   at ICSharpCode.ILSpy.TextView.DecompilerTextView.<>c__DisplayClass31_0.<DecompileAsync>b__0()
```

Da war doch noch was…..

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```
// YR.Core.yrEngine
using ...

public class yrEngine
```

```
RouterConfig_Username = "loco";
```

```
RouterConfig_Password = "ySyteMJwWuyAyMu84D";
```

```
public static string RouterConfig_FtpPath = "ftp://10.80.0.1/YachtRouterGen3.xml";

public static string RouterSupportInfo_FtpPath = "ftp://10.80.0.1/SupportInfo.png";

public static string extenderIdentity = "YR_WIFI_EXTENDER";

public static string rootExtenderDHCPServer = "dhcpBACKBONE";

public static string bridgePrefix = "bridgeEoip_";
```

Zusammenfassend

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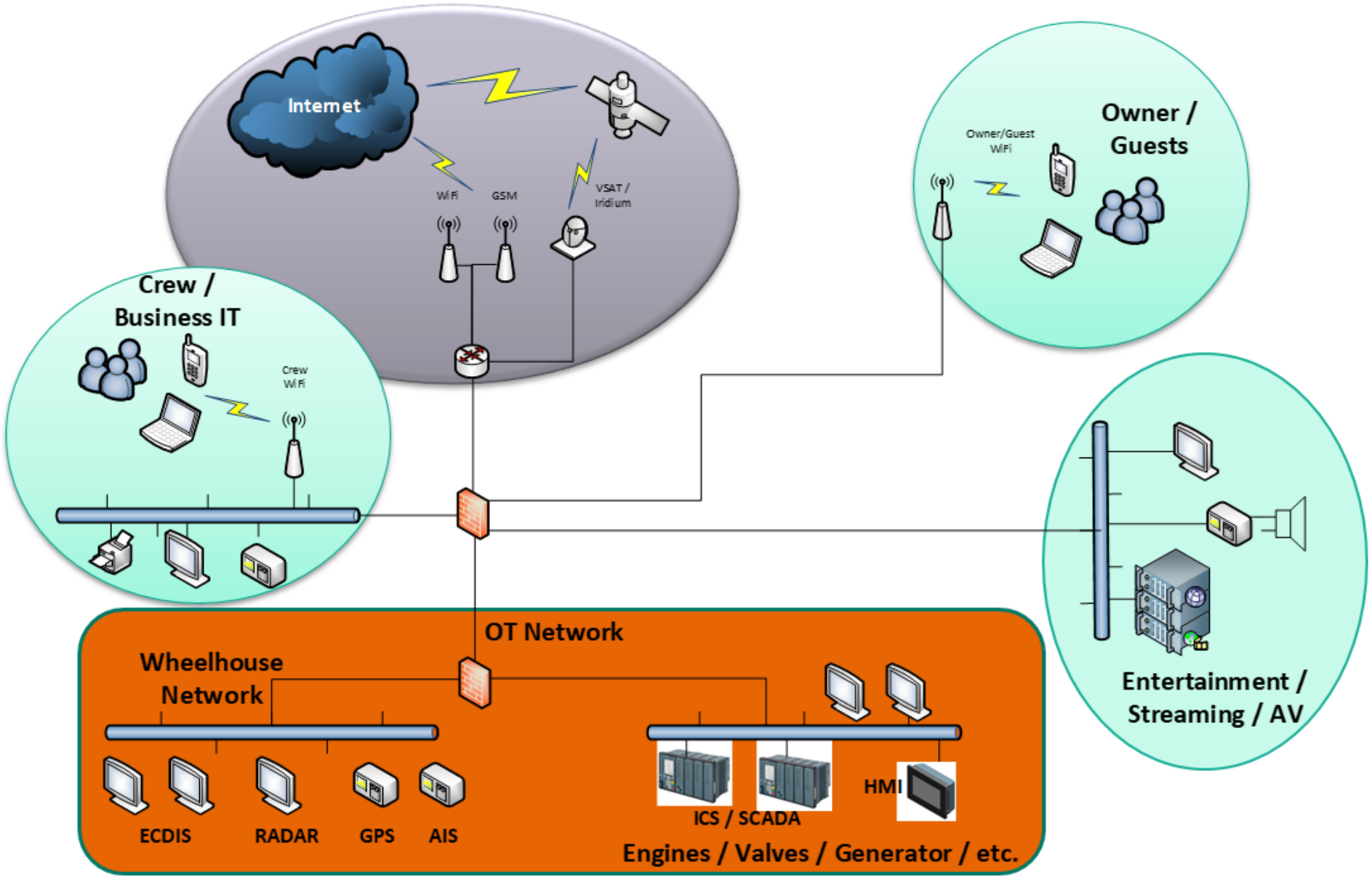
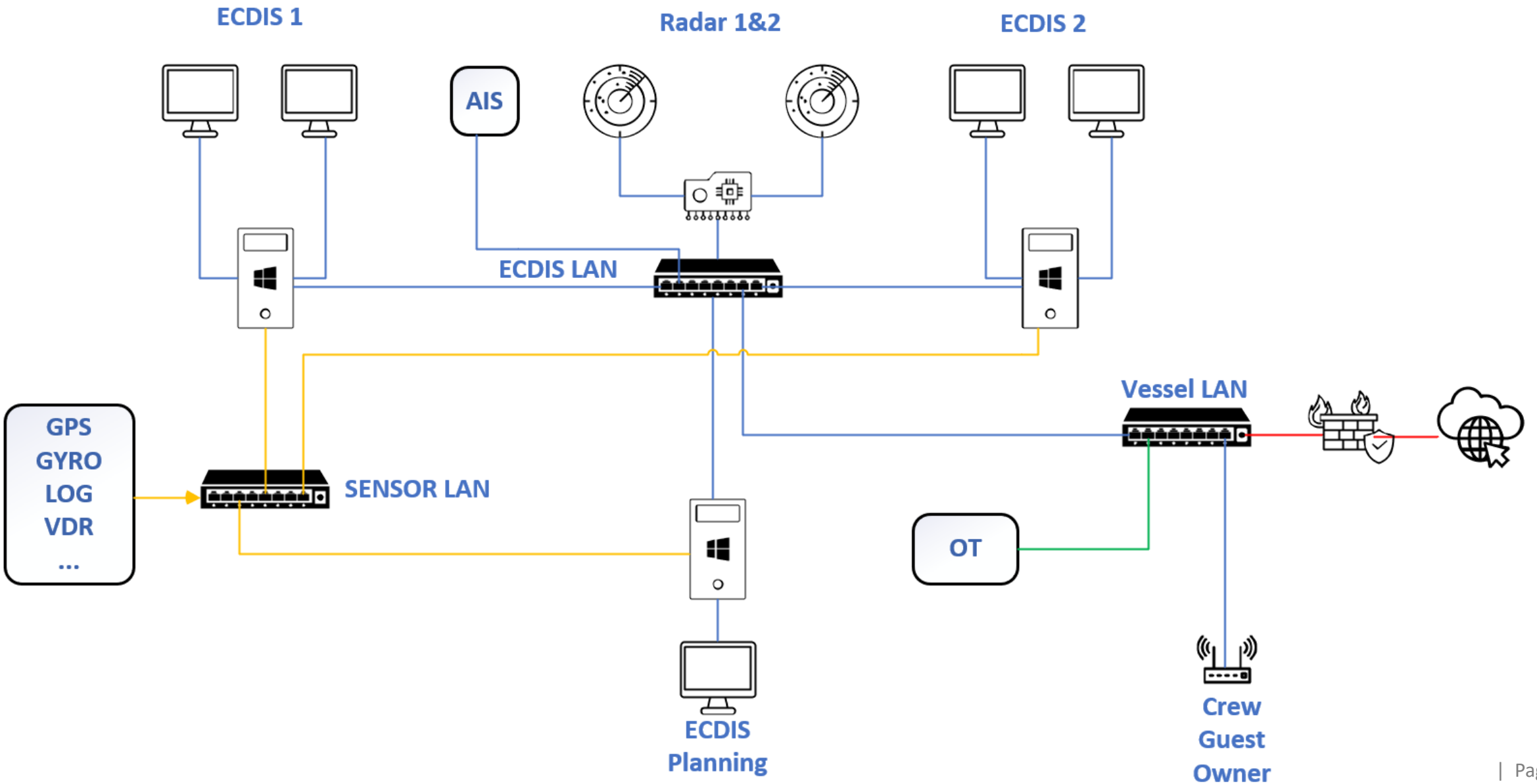
- SSH ersetzt FTP - gut
- Obfuscated Exe + DLL in Windows Version - schlecht
- Android APK not obfuscated - schlecht
- iOS Version nicht getested
- Hardcoded credentials in yrEngine - schlecht
- Aus dem Internet SSH & Winbox offen - schlecht


Internet
Wi Fi
GSM
VSAT / Iridium
Owner / Guests
Owner/Guest WiFi
Crew / Business IT
Crew Wi Fi
Entertainment / Streaming / AV
OT Network
Wheelhouse Network
ECDIS
RADAR
GPS
AIS
ICS / SCADA
HMI
Engines / Valves / Generator / etc.

Ein Blick hinter die Kulisse

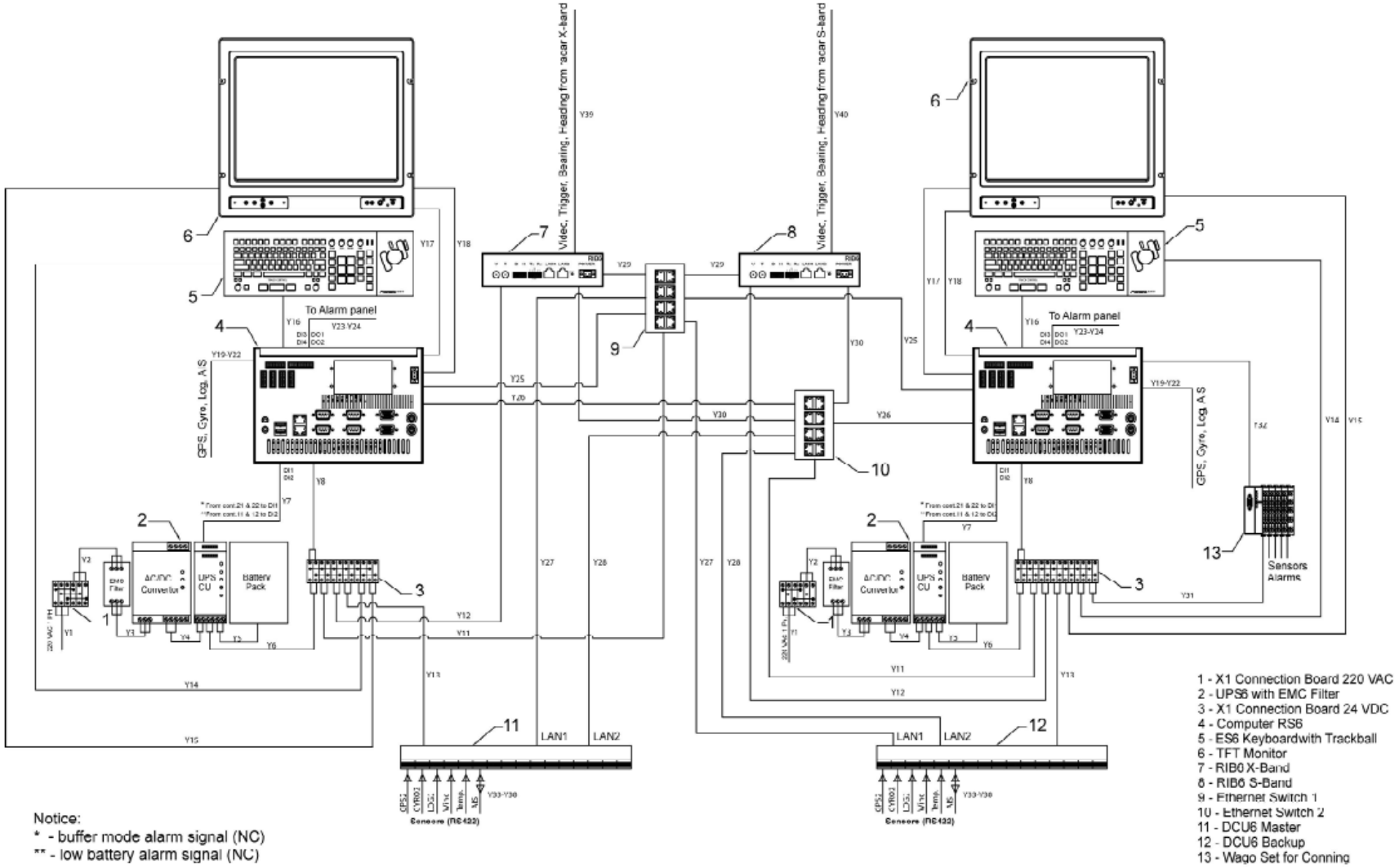
Electronic Chart Display - ECDIS

Navigationssysteme



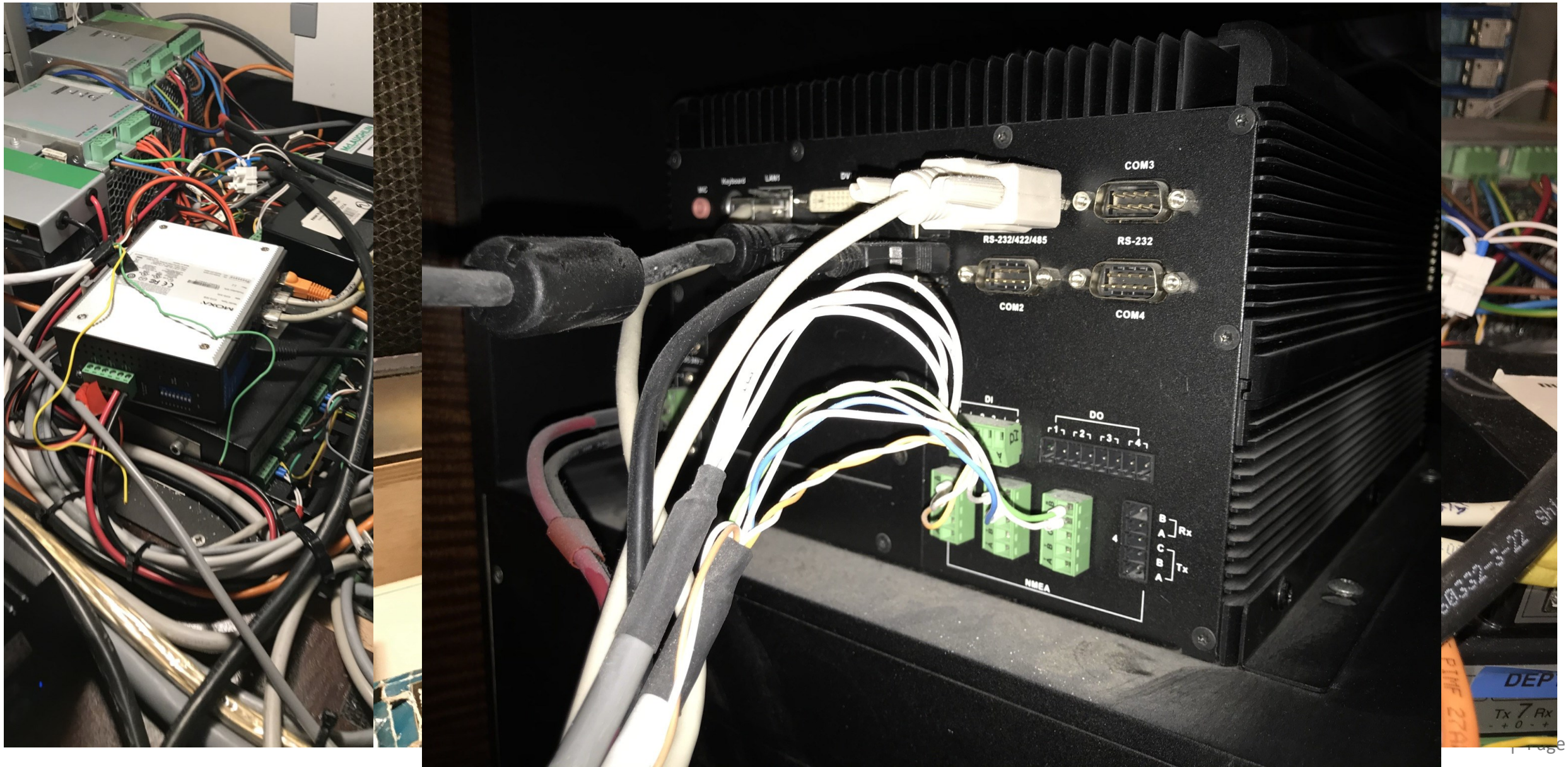
Electronic Chart Display - ECDIS

NS 4000/4100 ECDIS MFD (WS1 AND WS2). OPTIONAL CONFIGURATION. BLOCK DIAGRAM



https://www.marinsat.com/marinsat/dosyalar/dosya/NS4000_4100_ECDIS_Installation_Guide_eng.pdf

Ein Blick hinter die Kulisse



Navigationsnetz

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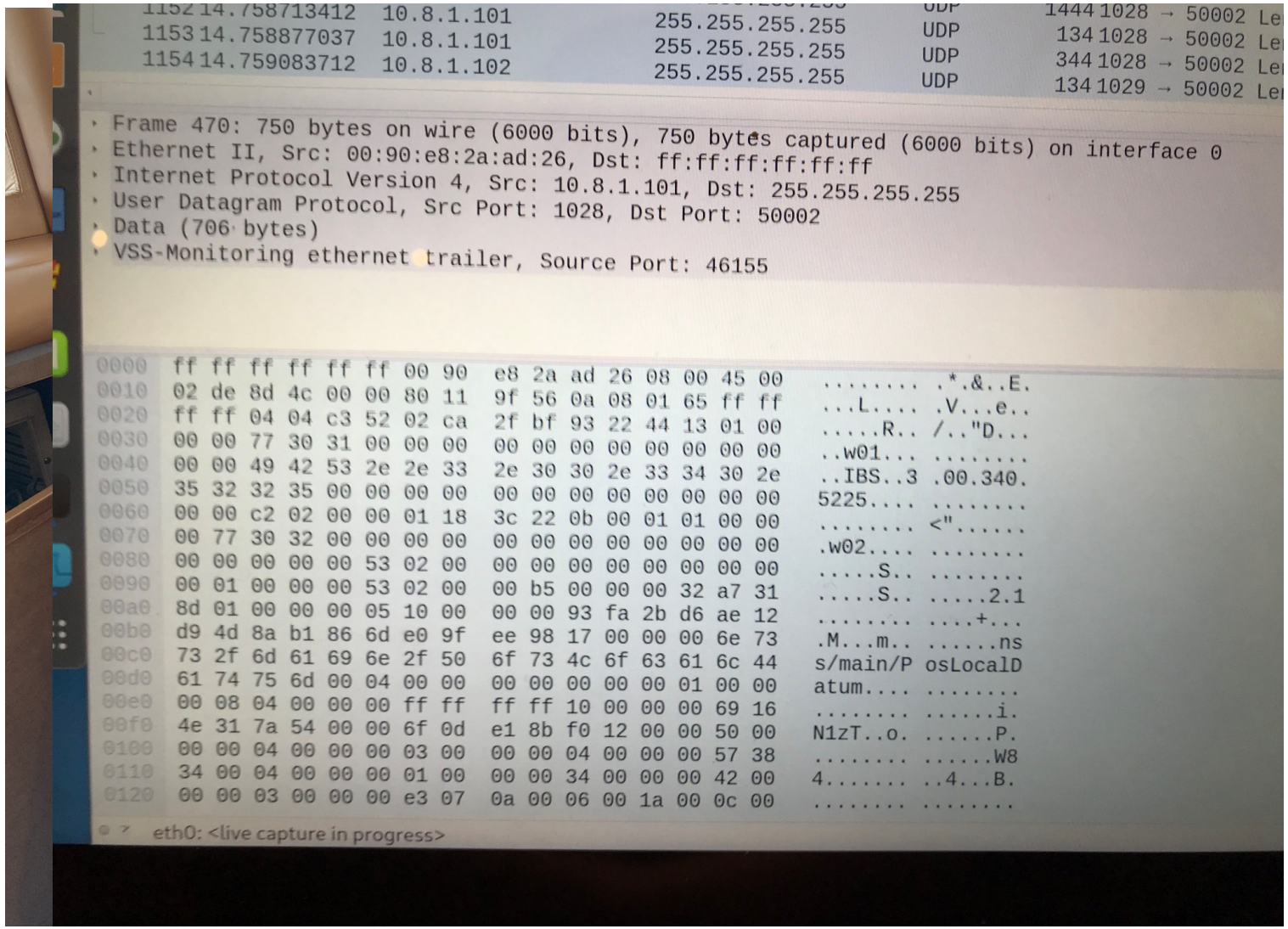
- Oft legacy (WinXP/Win7)
- Vorsicht beim Pentest
- Besser nur passiv Mithören!



Von klein bis groß

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- Maschinenraum
- Energie
- Und vieles mehr

Ein Blick hinter die Kulisse

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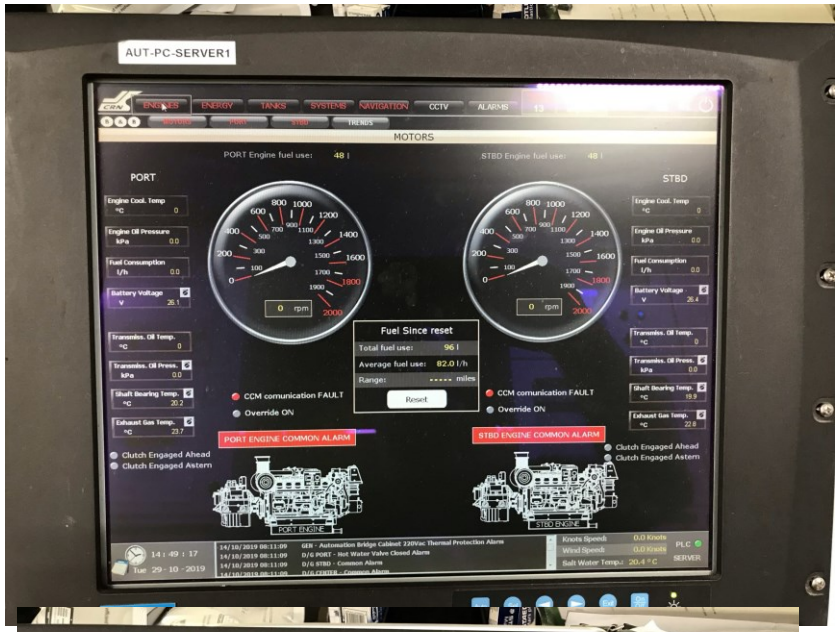

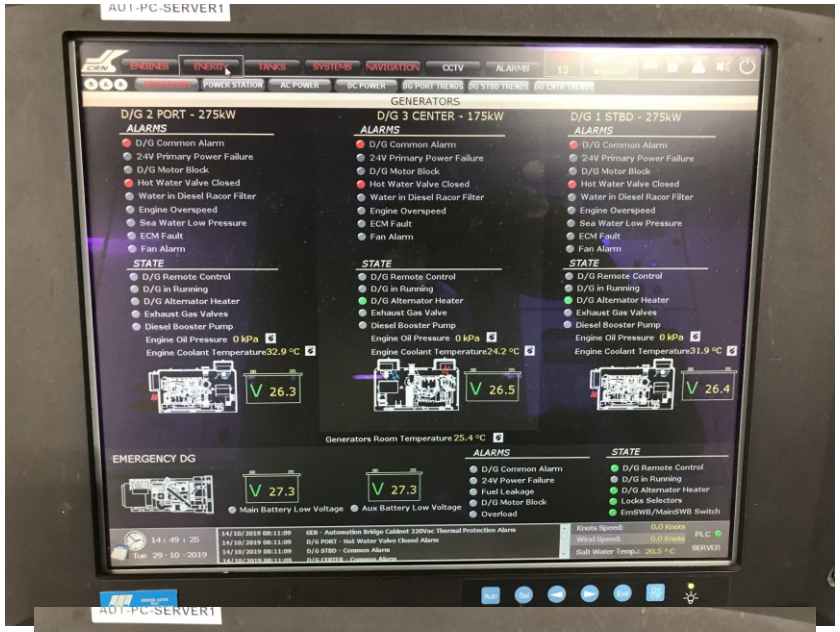

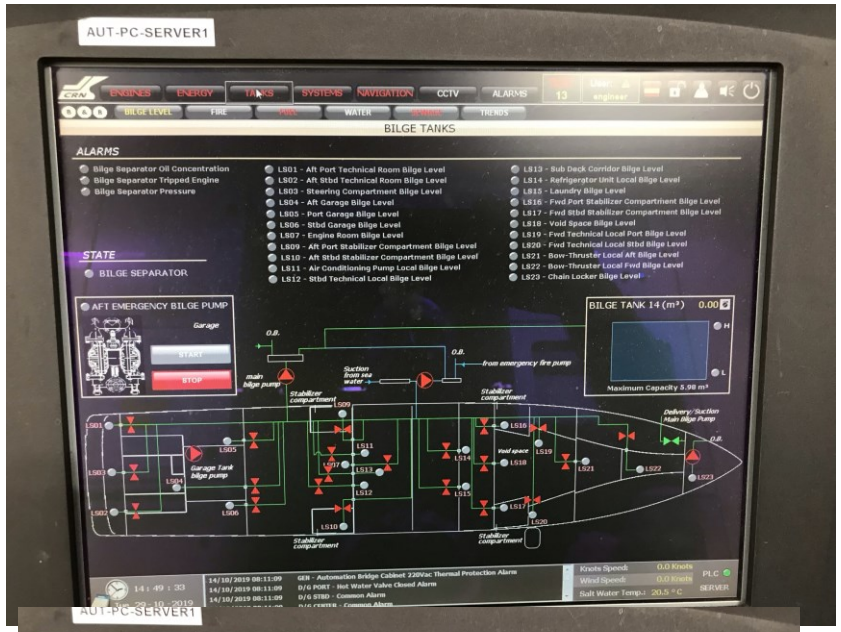

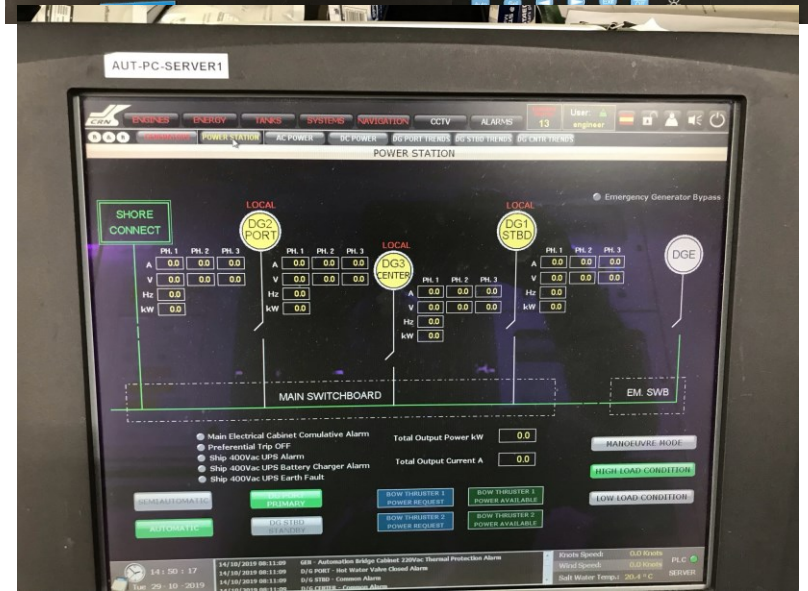

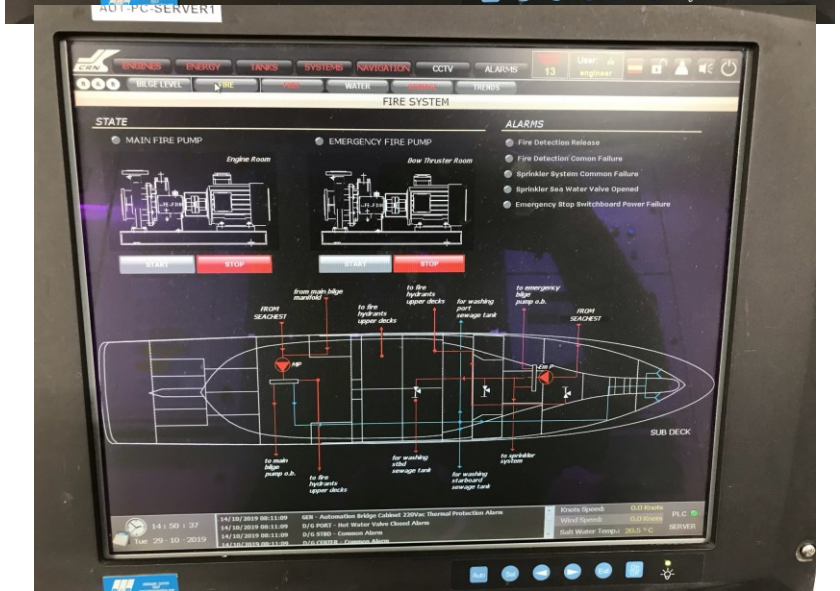

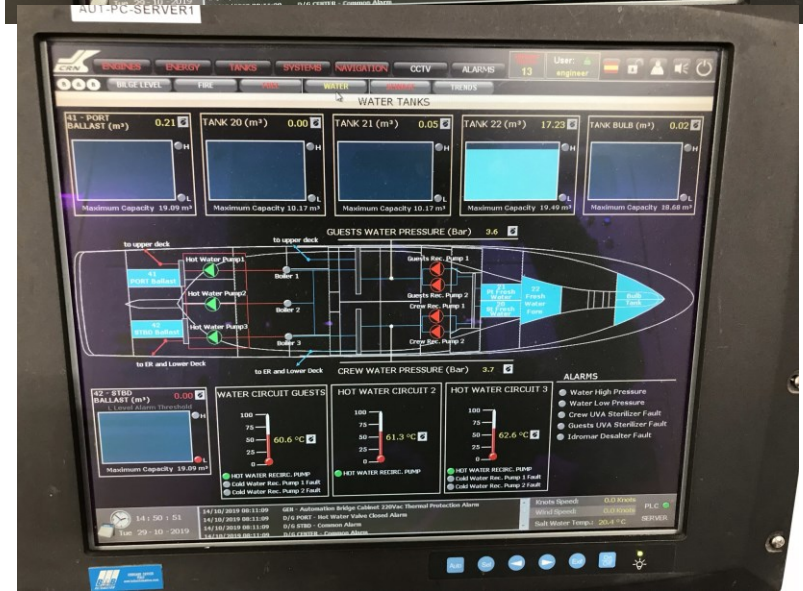

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Der Hauptzweck besteht darin, ein Schiff durch die Steuerung des Antriebssystems

in einer bestimmten Position zu halten

Operationen durchzuführen, ohne seine Position zu verändern

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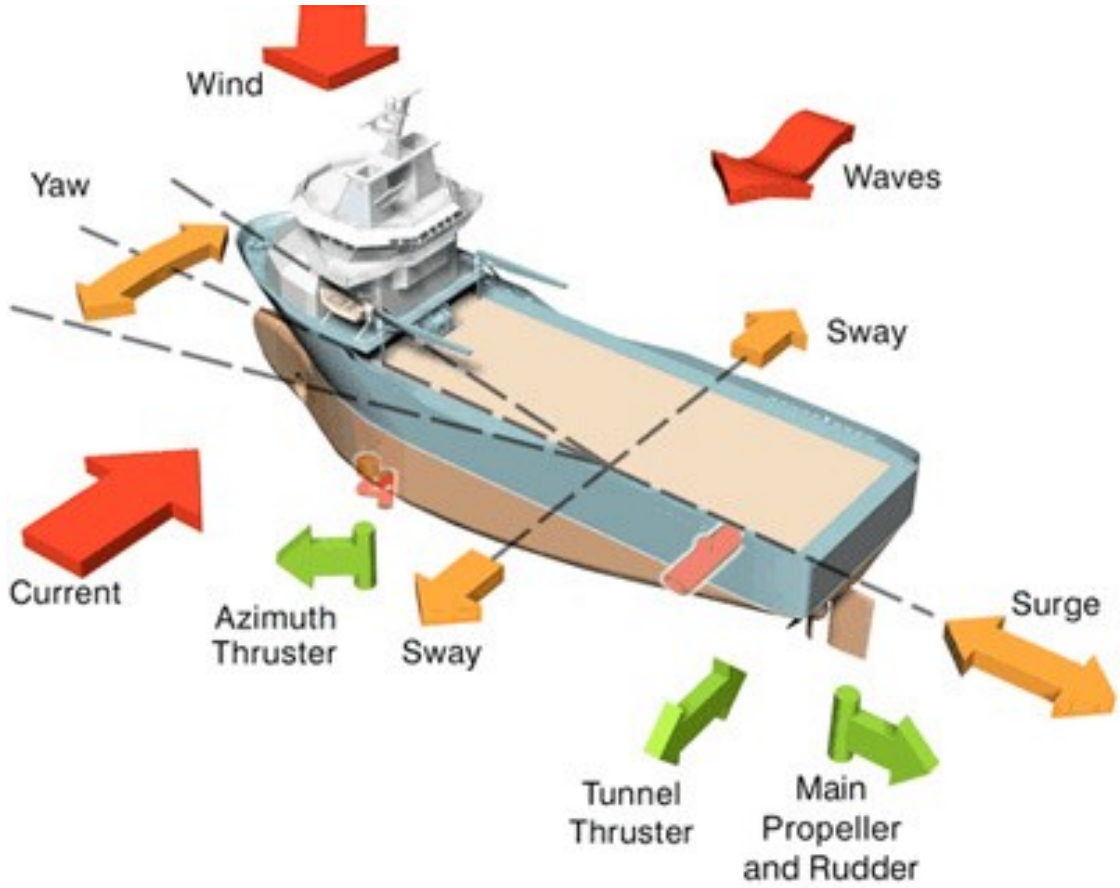
Schiffe

- yaw (Gieren/Schlingern)
- pitch (Nicken/Stampfen)
- roll (Rollen/Wanken)

- Sway (lateral movement)
- Surge (linear movement)
- Heave (vertical movement)



4 Klassen definiert

Alle Klasse DP1-DP3 gemeinsam:

- Automatische und manuelle Position & Kurs Steuerung

Fehlertoleranz:

Class 1

- Keine Redundanz. Positionsverlust kann beim Ausfall **einer** Komponente auftreten

Class2

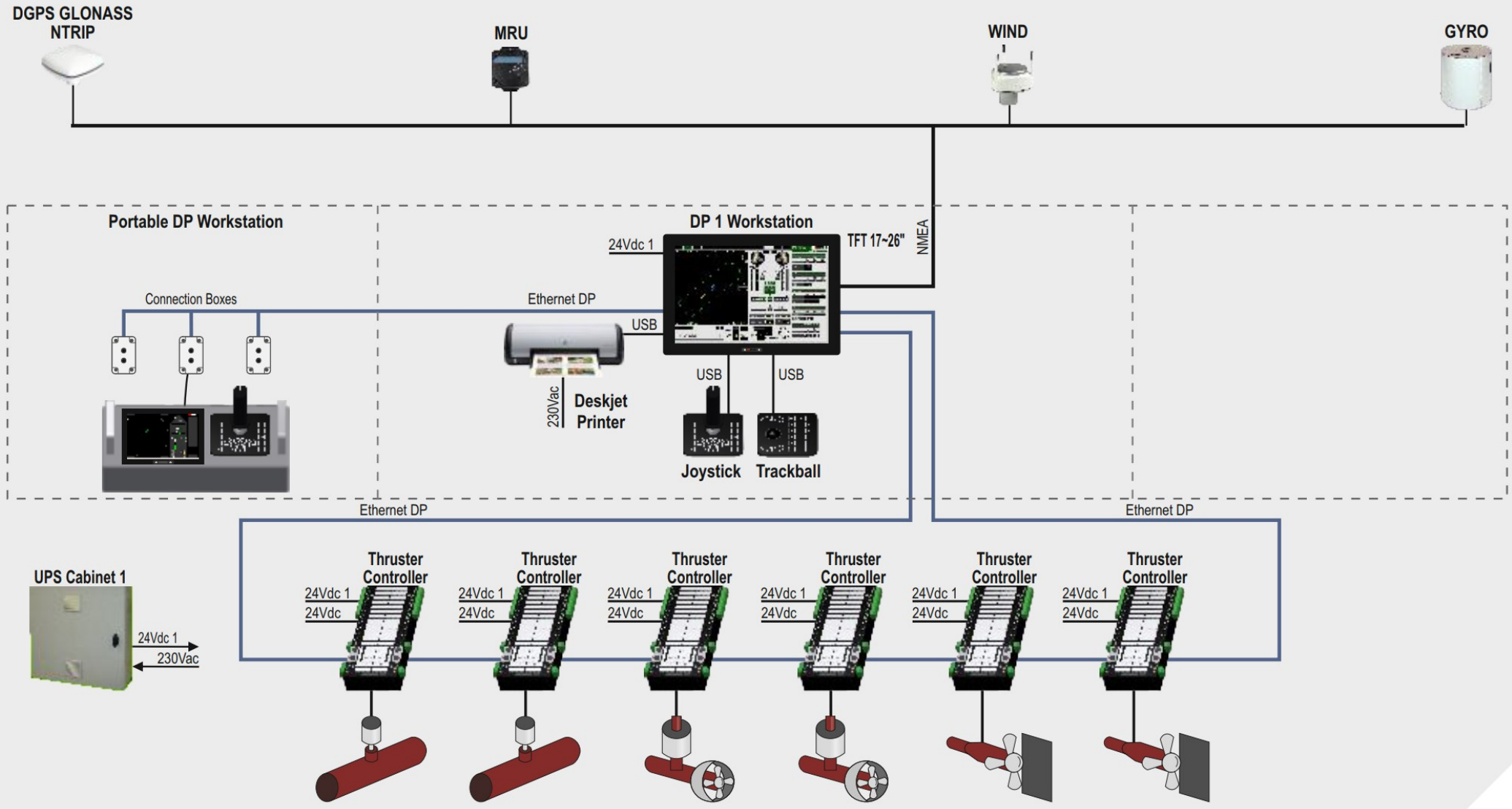
- Kein Positionsverlust bei Ausfall **einer** Aktiven Komponente wie „thrusters, generators, switchbords, remote control valves, etc“
- keine redundanten Systeme

Class 3

- Kein Positionsverlust bei Ausfall **jeweils einer** Aktiven Komponente wie „thrusters, generators, switchbords, remote control valves, etc“ sowie Brand oder Flutung der Segmente.
- mehrfach redundante Systeme and Segmentierten Orten

Dynamic Positioning

DP0



Compliance vorgaben

Maritime Safety Committee & International Maritime Organization

- Resolution MSC.428(98) - Maritime Cyber Risk Management in Safety Management Systems
- MSC-FAL.1-Circ.3-Rev.2 Guidelines on maritime cyber risk management.

IACS - International Association of Classification Societies

- - UR E22 Computer-based systems
- - UR E26 Cyber resilience of ships
- - UR E27 Cyber resilience of on-board systems and equipment
- - Rec 166 - Recommendation on Cyber Resilience

Contact

Questions?

Thank you for
your attention!

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Socials:
@obiwan666

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security-unter-kontrolle.de/

Monthly „Security-Briefing für HardHats“:
admeritia.de/hardhats

Blog:
fluchsfriction.medium.com