

Aid to Navigation on Demand Fog Lights

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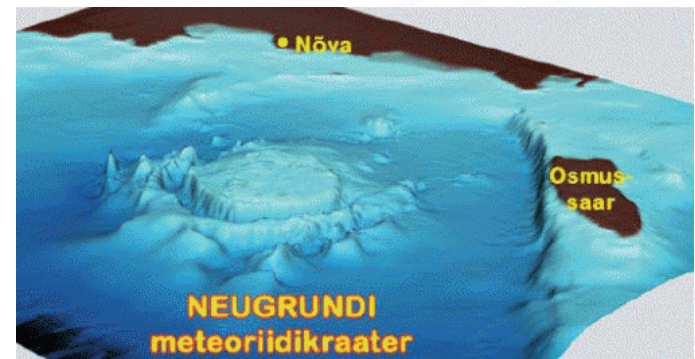
Cybernetica AS

- ⊙ An Estonian private limited ICT R&D company
- ⊙ ISO 9001:2008 certified original equipment manufacturer and turnkey solutions provider:
 - ⊙ eGovernment systems and information security software
 - ⊙ Marine navigation safety infrastructure components, AtoN lights
 - ⊙ LED based visual light signalling products and systems
 - ⊙ Telematics / monitoring equipment and software
 - ⊙ Coastal wide area radio and data communication systems
- ⊙ Complex ICT systems integrator
 - ⊙ Border surveillance and other radar / video / sensor systems

Osmussaar (Odensholm)



- ⊙ Nordisk Familjebok, 4. bind, duplikator – Folkvandringen fra 1881 (s.271) skriver på svensk at Odins grav ligger på en skråning på Odensholm, hvor man kan se "óts tráver" eller "Odins fodspor" – reference to Odin's grave and footprints
- ⊙ Eastern embankment: Askom, Askombäckan – Aesir hilltop, landfall and home of the Aeses (Odin, Thor et al)
- ⊙ The Neugrund meteor crater
 - ⊙ Impact 535M years ago
 - ⊙ Estimated meteor size: Ø 1 km
 - ⊙ Crater: Ø 21 km, discovered in 1998
 - ⊙ Neugrund shoal marked by buoy 415



Problem: Navigation Safety in Fog

**Passageway between the rocks
at ferry terminal approach:
60m**



Sandvikvåg Ferry Terminal Approach



Picture courtesy of Kystverket

Light Signalling in Marine Advection Fog

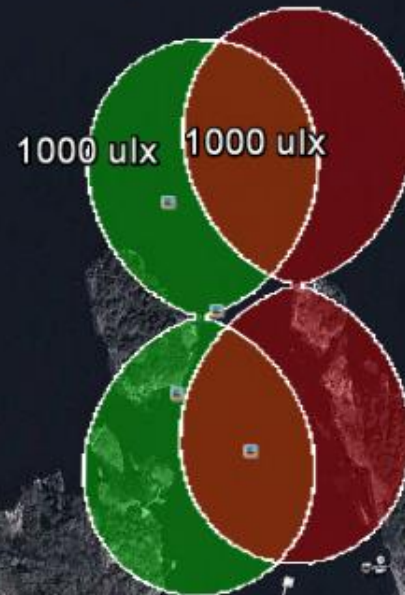
Results of our research & fact finding mission:

- Large fog particle size: $>10\text{ }\mu\text{m}$, heavy attenuation (scatter)
- Wavelength dependence of attenuation is insignificant
- Best propagation in fog: pure monochromatic light signals
- Fog sensors can be costly and tricky to apply (where?)
- Use of omnidirectional fog lights is impractical

Visibility [m]	Attenuation [dB/km]	TM	Weather description
30	350	3.95E-81	< 50m Dense fog
50	275	5.73E-49	
100	140	7.57E-25	
150	80	8.30E-17	
200	65	8.70E-13	50..200m Thick fog
250	50	2.25E-10	
300	40	9.11E-09	

Solution: Occasional Fog Lights

Daytime nominal range
in 100 m visibility conditions



Visibility Testing of AtoN Lights in Fog

Our conclusions and hypotheses:

- Only highly conspicuous intensive flashing light is feasible
- Fixed and flashing lights may improve orientation in fog
- Rhythmic character F.Fl.(2) proposed: 0.2+0.1+0.2+0.5, 1s
- Flashing of lateral marks in opposite phase may further improve orientation in fog by avoiding volume saturation
- Manual activation of fog lights should be implemented
- Cybernetica built a 32 m fog tunnel on rooftop testbed to attain line-of-sight visibility of 6m and below producing high pressure water mist using 27 fog nozzles
- Particle size $\sim 33 \mu\text{m}$, generation volume $\leq 2.2 \text{ l/minute}$
- Observation distances up to 30 m, track width $\sim 1 \text{ m}$

Cybernetica Fog Testing Tunnel

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- High pressure atomized $\sim 33 \mu\text{m}$ water mist, 27 fog nozzles
 - Observation distance to lights is 30 m, track width $\sim 1\text{m}$

FFL Implementation Examples: Japan

AtoN No.	Rhythmic Character	Nominal Range of Fixed Component [M]	Expected Fixed Luminous Intensity [cd]	Nominal Range of Flashing Component [M]	Expected Luminous Intensity in Flash [cd]	Relative Luminous Intensity of the Fixed Light Component [%]
11476	F.FI.(2)R, 10s	3	15	7	279	6%
11860	F.FI.R, 5s	5	78	8	492	16%
29880	F.FI.G, 10s	7	279	9	1034	27%
5052	F.FI.R, 5s	6	152	10	1401	11%
11772	F.FI.G, 6s	5	78	11	2287	4%
4156	F.FI.(2)R, 8s	6	152	11	2287	7%
11800	F.FI.G, 5s	7	279	11	2287	13%
2624	F.FI.(2)G, 10s	5	78	12	3672	3%
11804	F.FI.R, 5s	8	492	12	3672	14%
11440	F.FI.R, 6s	6	152	12	3672	5%
3200	F.FI.(2)R, 8s	9	1034	14	9101	12%
11438	F.FI.W, 5s	10	1401	16	21643	7%

Over 40 instances of F.FI.(2) rhythmic character used (~15% of total)

AtoN Fog Light System with Telematics

Users on cellular networks
(using smartphones on ships)

Optional external users on the Internet



GSM/GPRS/3G
Radio Network

TCP/IP
(Internet)

Regular status reports

Activation/deactivation
commands

GSM Operator's
Gateway

Institutional
Firewall / LAN

TLSC
Server

Administrator

AtoN Operator

E8555
Fog Lights and
Telematics
Module
TelFiCon™
On HIB

TLSC:
TeViNSA™
(Telematics for
Visual Navigation
Situational Awareness)
Limited Server Component

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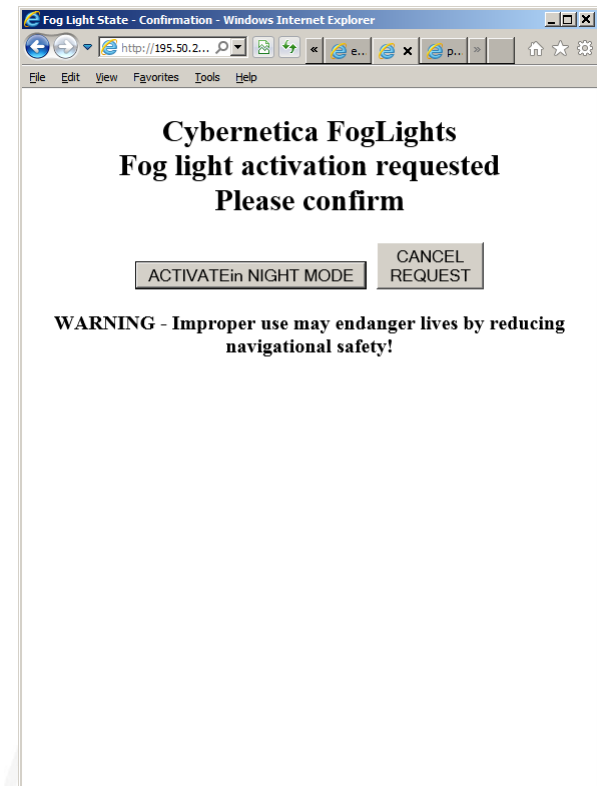
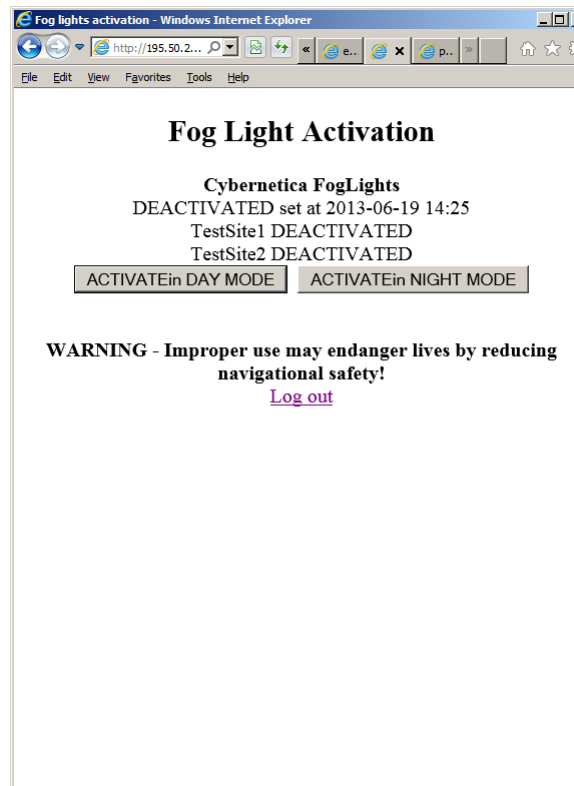
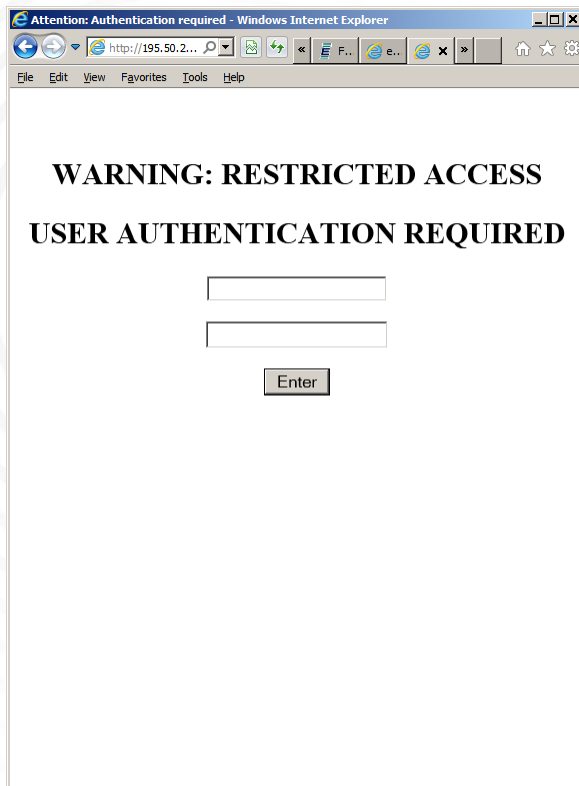
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Web-based Control of Fog Lights

- AtoN-on-Demand (AOD) functionality for Internet based control of occasional lights was implemented in our TeViNSA™ Limited Server Component software
- Special fog lights user group has limited access:
 - Simple standard web browser based interface with user authentication and event logging for professional users (smartphones, -pads etc): one button per group
 - One log-in from same device per day is required; user authentication lasts until midnight
 - One of the two intensities can be activated: „DAY“ or „NIGHT“
 - The user is provided with fog light status at activation attempt
 - All user actions and system state changes are logged

TLSC Webpages for Fog Light Activation

- Simple 3-page interface is provided to fog light users identified upon log-in, fast and smartphone-adapted:



First Fog Lights on Demand Deployment

- Installed at Sandvikvåg, Norway in September 2013 by the Norwegian Coastal Administration (Kystverket)
- Fog light host structure: HIB AtoN fixed in seabed rock
- „Dry tests“ successful
- First trials in actual fog conditions are successful - comment from ferry navigators: „very good“
- Added value: platform collision monitoring and on-demand vibration measurement by telematics module
- Another e-Navigation application

Thank you for your attention. Questions?

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