SWEDISH MARITIME ADMINISTRATION
Operations

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DateDate
10 April 2007

Our referenceOur reference

Your dateYour date

Your reference

PROGRESS REPORT
PHOTOVOLTIC SUPPLIED LED-FLOODLIGHTING

A large number of Swedish lighthouses are externally floodlighted with projected indirect reflection illumination. See fig 2.

This important feature rely on mains supply due to the power required, typical 250W continuous 14h/day, the economical implications for new installations are limiting. Also the service and repair of the necessary underwater cables takes its increasing toll of budget.

Nevertheless the economic aspects, floodlighted lighthouses are today a appreciated feature by the mariners, regarded as more important than the traditional flashing light. SMA, seldom gets reports on main light failures, but failures on floodlighted beacons are instantly reported.

In 2001 the work to find alternative solution to mains powered floodlights started, the time was right with respect to developments in the LED-technology.

An early decision was taken, not to endeavor along the path of projected indirect reflection, due to its very low efficiency, just a minuscule amount of light is directed to the observers eye by reflection, compared to the light source power. Hench, direct diffused emitted light was the method adopted for development.

The first field test can be seen on fig 3. The pipes are prototypes with LED placed axially inside the clear acrylic tube, length 1m, c-c between LED 25mm. On the opposing side from the LED is a linear lens and diffuser fitted inside the tube. See also appendix with test report. NB that the power drawn in each pipe was only 0.43W !

By this low power the observing pilots was satisfied: *The pilot CB especially, but also other pilots observing the lighting where all positive regarding the effect. The lighted projected area is more important than the brightness.*

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Fig 4, 5, 6, 7 shows the first main installation of LED-floodlighting on an inaccessible lighthouse in the busy approach to Gothenburg, Sweden. Since late 2002 this installation has worked flawlessly, with only one pipe exchanged due to seawater ingress.

Fig 8, 9, 10, 11 illustrate the individual components.

Fig 12 is a draft drawing of the type of beacons erected, 35 pcs, in the new Gothenburg approach channel. All fitted with this type of PV-LED-floodlighting and PV-GPS-synchronised LED-lanterns.

The development of PV-LED-floodlighting continuous, the summer 2007 field-tests of a new improved version will be carried out. This version is more production adopted, i.e. lower price and will have better power/current control by means of advance use of PWM-technology.

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APPENDIX **12 November 2001**

TEST REPORT

Project: PV Flood lighting

The purpose of this project is to find the most efficient and suitable flood lighting from energy point of view with no mains connection needed.

Therefore, four ”strip lights” with LED-technique have been delivered from a company in California recommended by Automatic Power, Houston. The product is called Light Strike.
These ”strip lights” emits a diffuse yellow light.

These lights were tested 2001-11-08 at the lighthouse Gäveskär outside Gothenburg.
Weather: – 1 °C and clear visibility.

The ”strip lights” are 0,9 m long and vertically mounted below the eastern part of the railing, with 0,2 m space between them. Dark background towards West Vinga. The ordinary flood light was switched off.

Power source used was a standard adjustable power supply. To get a satisfactory impression of the ”floodlighting” only 0,43W per meter was needed (i.e. less effect than an ordinary flash light).

The pilot CB especially, but also other pilots observing the lighting were all positive regarding the effect. The lighted area is more important than the brightness. The ”strip lights” ought to be a little longer, preferably 1,2 m in order to increase the projected area.

With longer distance between the ”strip lights” you will get more of a Zebra-effect.

CB made clear that red or green defused light has a better conspicuity then white or yellow, which is very interesting due to the fact that you get the same visible effect with red or green LED and requiring less energy consumption.

No risk for a mix-up with lighthouse sectors was considered, because this red or green defused light is stationary and fix.

The lighthouse Buskars Kröte will probably be equipped with a solarpanels during 2002. This lighthouse is painted orange/red and today the tower gives a red reflection during the night using conventional light sources with 250 W power. The red ”Light Strike” ought to have the same apparent effect.

We also tested a LED-buoy lantern emitting fix yellow light mounted in the same level as the top of the lantern house. This test was negative as the light impression was only a vague yellow spot, no correct estimation of the distance was possible to do, as well as deciding whether the light came from a planet or a distant ship at anchor.

Our conclusion form this is, that the illuminated area is more important than the luminous intensity is for the brains capability to calculate distances at night.

Conclusion:

The Light Strike seems useful and relevant to use in this kind of application.

The power needed for a lighthouse of normal size is within 5W, in total 10 pcs of tubes 1,2 m giving 5,16W. This is even more realistic using red resp. green LED.

Still remains a lot of work to find a robust casing for marine use within environmentally accepted norms.

The development will now continue by specifying and ordering a number of 1,2 m red Light Strike tubes for further tests. It is also essential that these can be directly connected to a 12 V battery system by an integrated current regulator.

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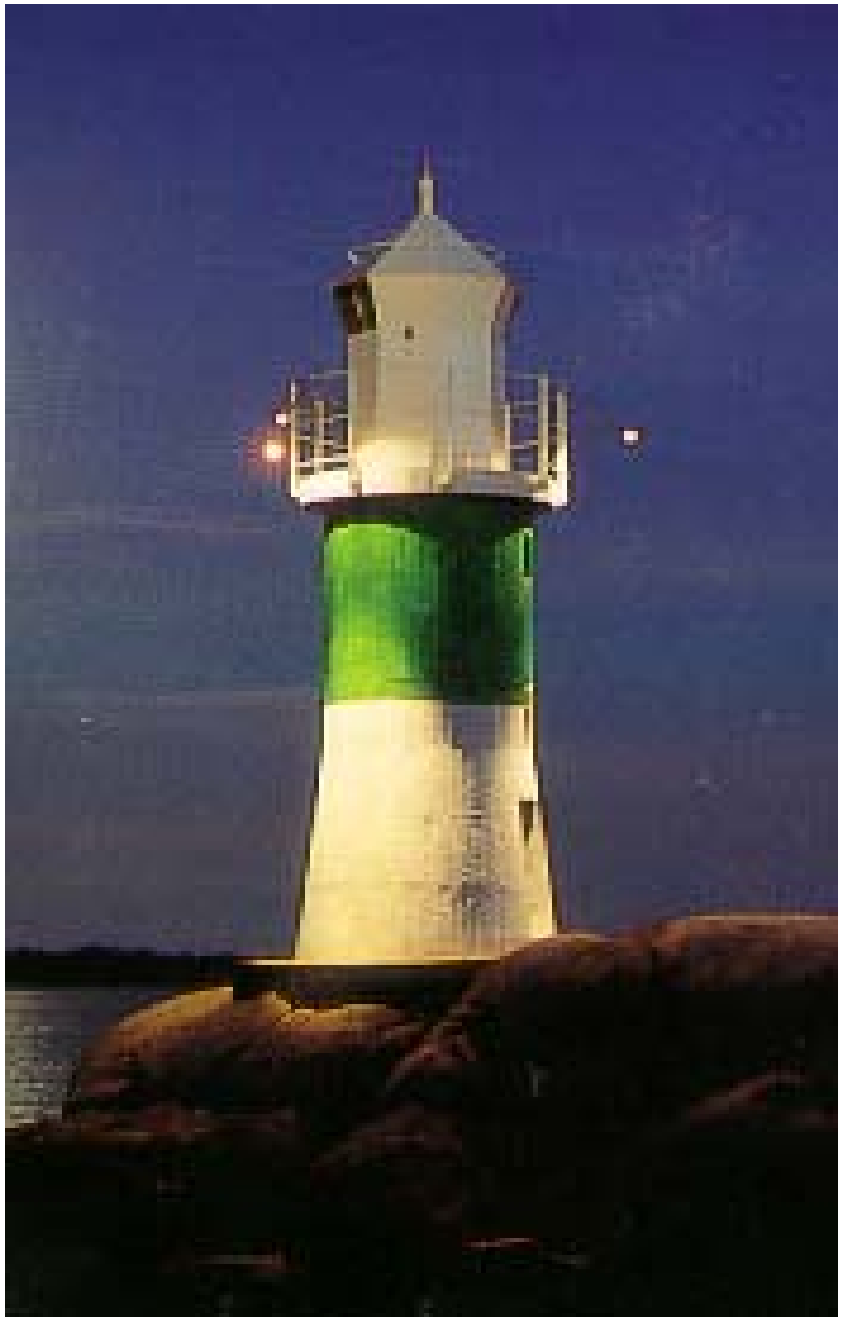
Typical Sw. lighthouse

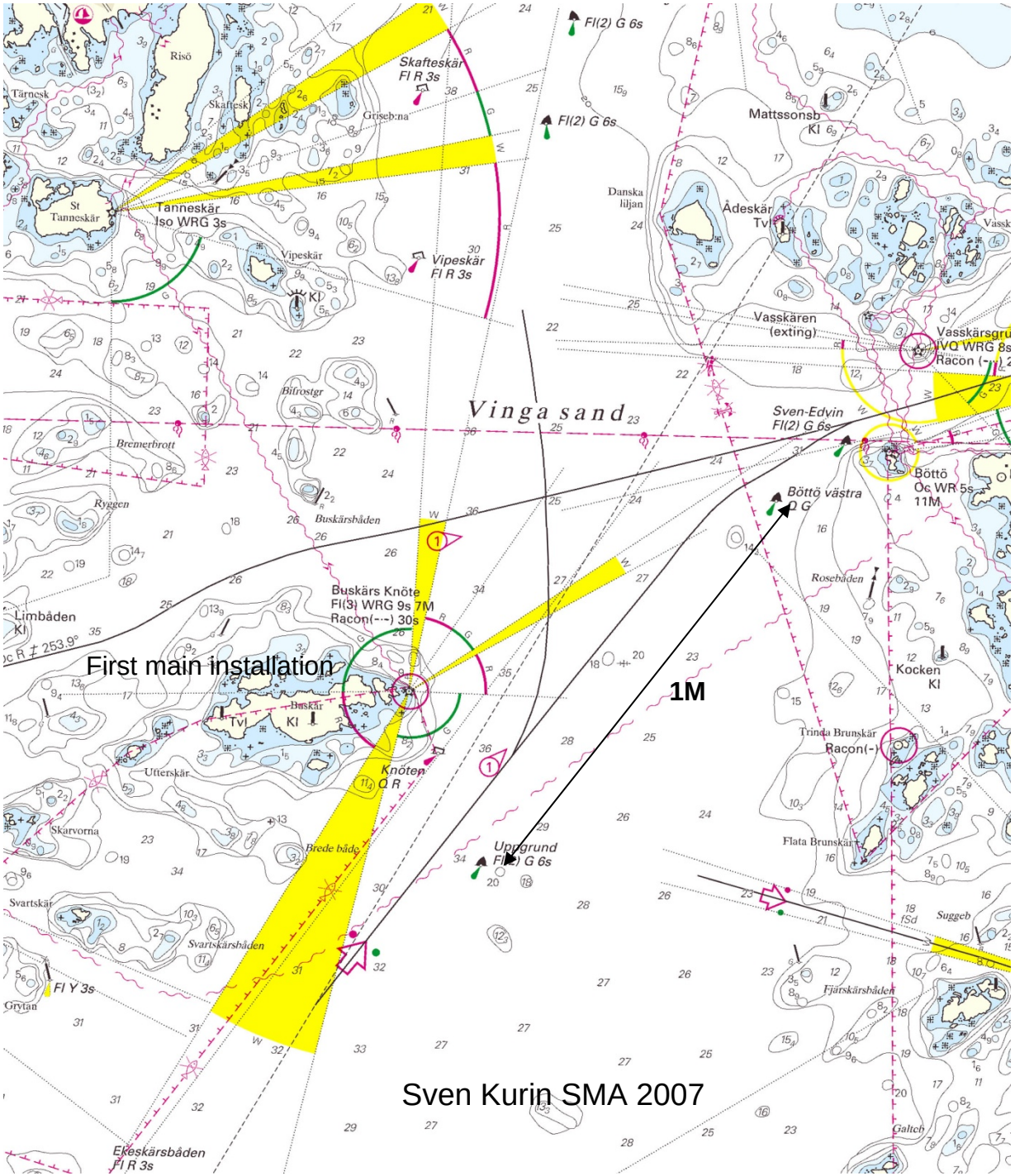
Flood lighting of tower and rock base.

Total illumination power 250 W

Projected indirect reflection



Test trails with yellow short LightPipe



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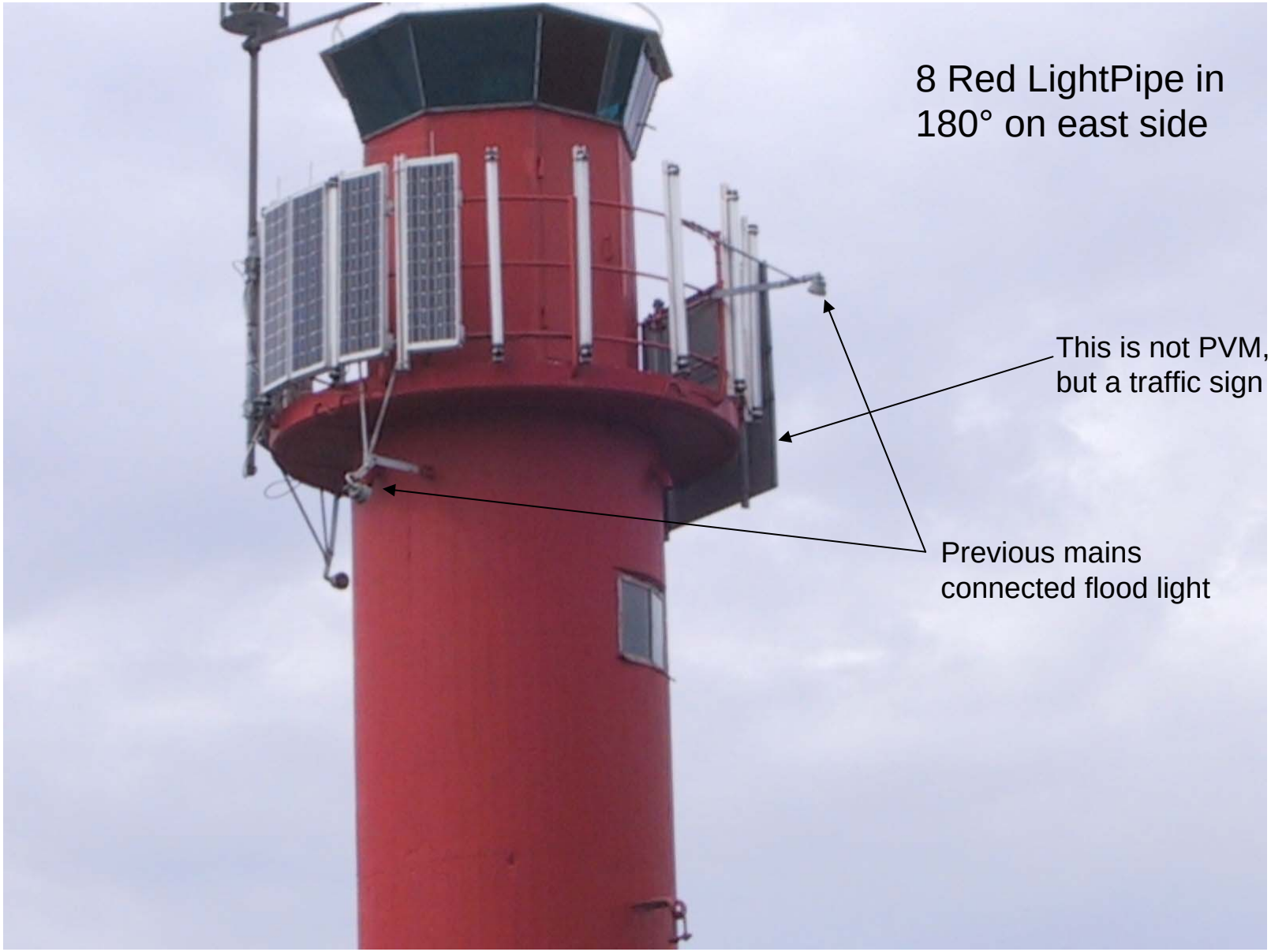
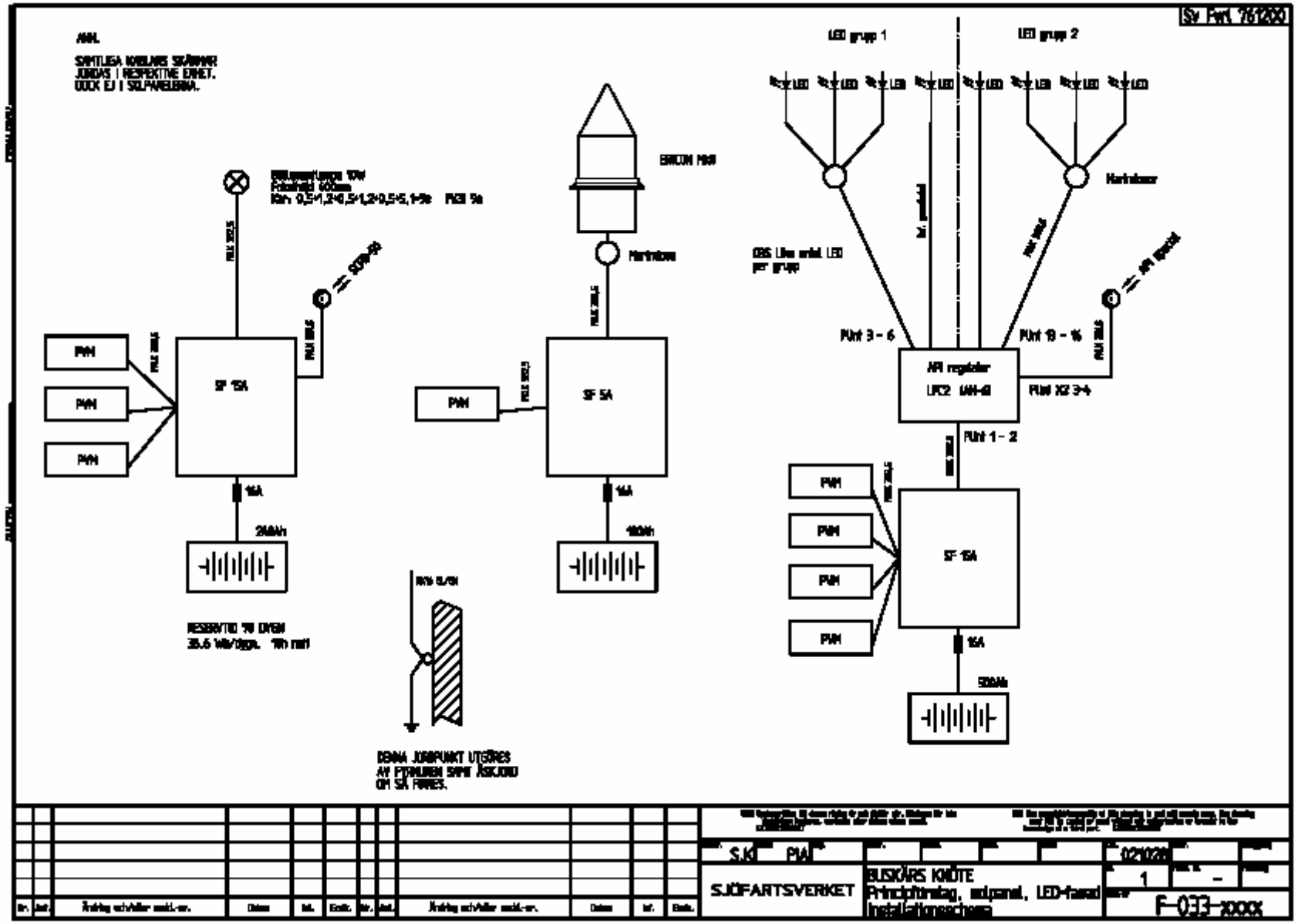
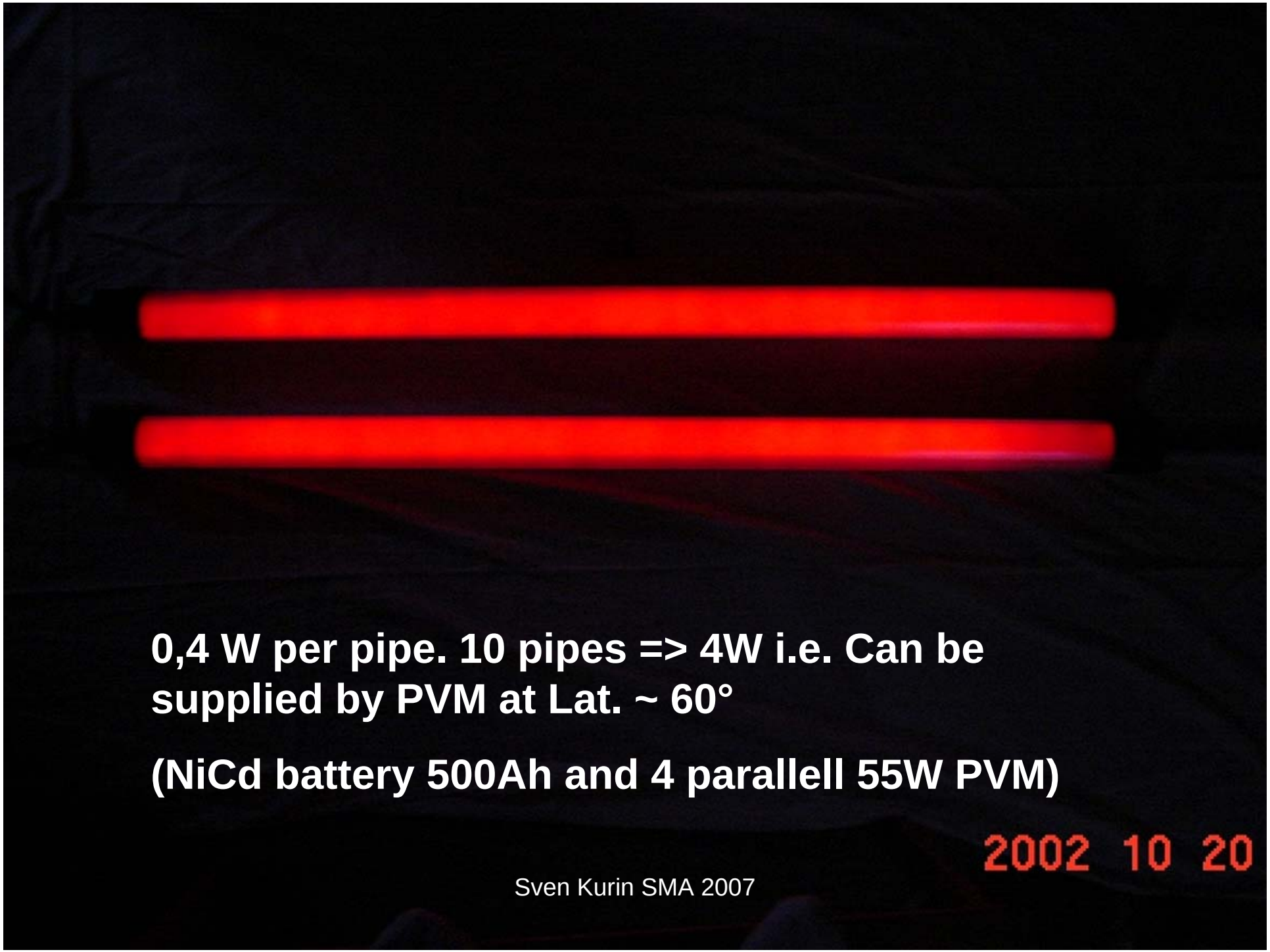

8 Red LightPipe in
180° on east side
This is not PVM,
but a traffic sign
Previous mains
connected flood light

Three separate redundant power systems for lighthouse equipment



LED-Pipes for ”floodlighting”

Length 1.2 m


0,4 W per pipe. 10 pipes => 4W i.e. Can be supplied by PVM at Lat. ~ 60°
(NiCd battery 500Ah and 4 parallell 55W PVM)
2002 10 20
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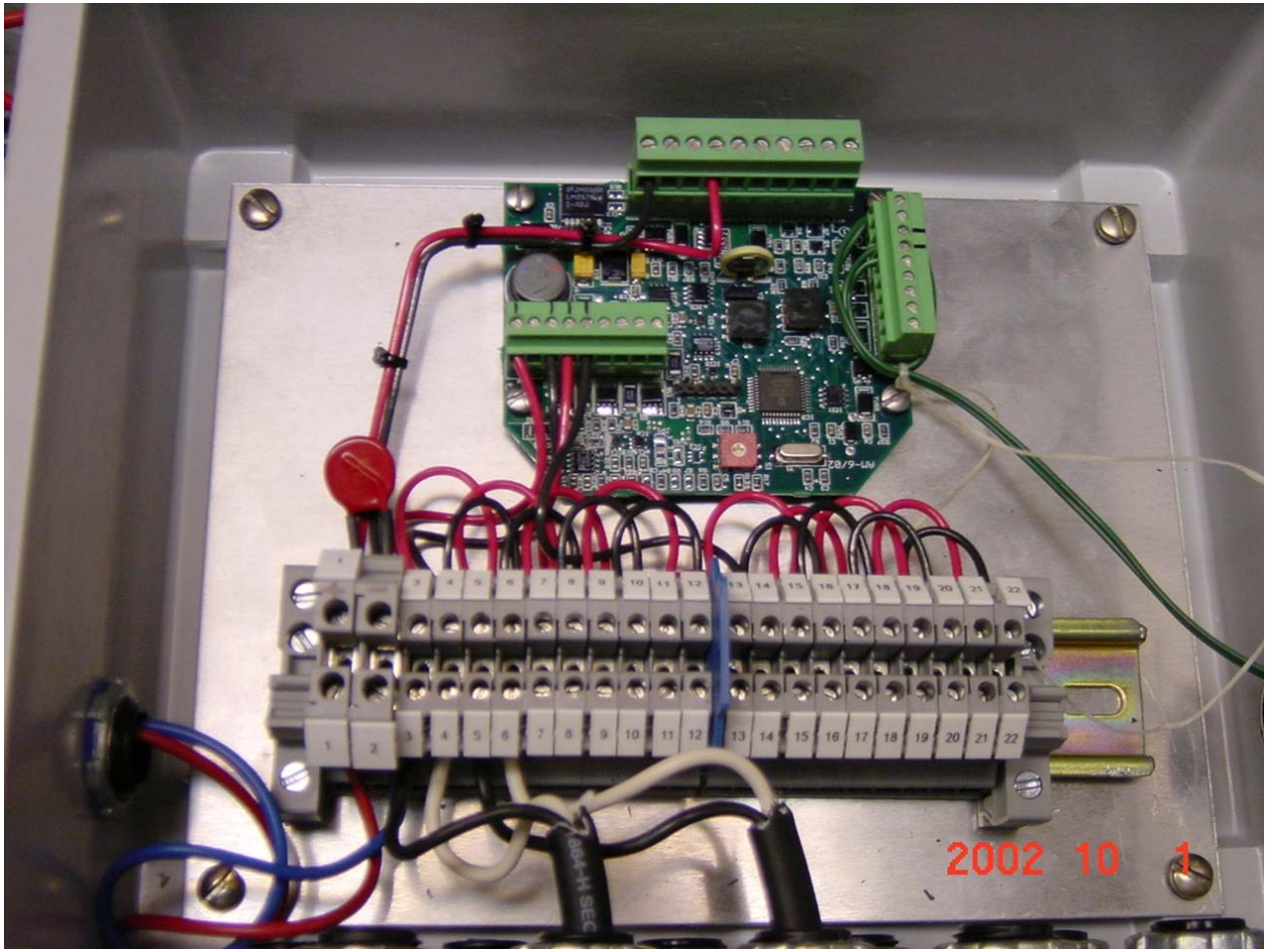
Extract from mfg data sheet

Parameters	LITEPIPE-II LED Illumination System				
	Red	Amber	Blue	Green	White
Luminance (fL)	100	25	20	75	60
Color λ)	615	590	470	525	White
Projected Life (Hours)	>50k		>20k		>10K

My recommendation is use of Red or Green. Amber give “dirty grey” light at low current.

Switched current regulator



New Gothenburg fairway Lateral marks 35 pcs PV power