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13. ABSTRACT *(Maximum 200 words)*

This work involves design and construction of a 10-laser lifetime testbed that measures, under computer control, different wavelength based characteristics at elevated temperatures over a period of 5000 hours. The objective is to quantify and analyze the various wavelength tuning aging characteristics of tunable semiconductor lasers: the Altitun GCSR And UCSBSGR (ONR funded), and identify physical aging mechanisms and relate back to fabrication. Our approach is to measure the wavelength characteristics of the tunable lasers using accelerated lifetime testing by maintaining the tunable laser at 65o C and automate the data collection of the characteristics over 5000 hrs.

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Annual Progress Report
Grant N00014-97-1-G024

"Tuning And Aging Characteristics of Multisection Wide Wavelength Tunable Semiconductor Lasers"

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Executive Summary

This report covers work to date on analysis of wavelength tuning characteristics under accelerated aging lifetime measurements. This work involves design and construction of a 10-laser lifetime testbed that measures, under computer control, different wavelength based characteristics at elevated temperatures over a period of 5000 hours.

Objective

Quantify and analyze the various wavelength tuning aging characteristics of tunable semiconductor lasers: the Altitun GCSR And UCSBSGR (ONR funded). Identify physical aging mechanisms and relate back to fabrication

Approach

Measure the wavelength characteristics of the tunable lasers using accelerated lifetime testing by maintaining the tunable laser at 65° C and automate the data collection of the characteristics over 5000 hrs.

Progress to date

- Designed lifetime characterization testbed
- Ordered and received the following items: computer, multichannel optical spectrum analyzer, optical switch and single channel GCSR tunable laser.
- Ordered 10-laser GCSR mainframe scheduled for delivery on June 10, 1998.
- Written measurement control and data acquisition software (LabView) for lifetime testing of wavelength tunable characteristics for 10-laser mainframe.
- Installed 10-laser modules in mainframe and characterized modules for proper operation.

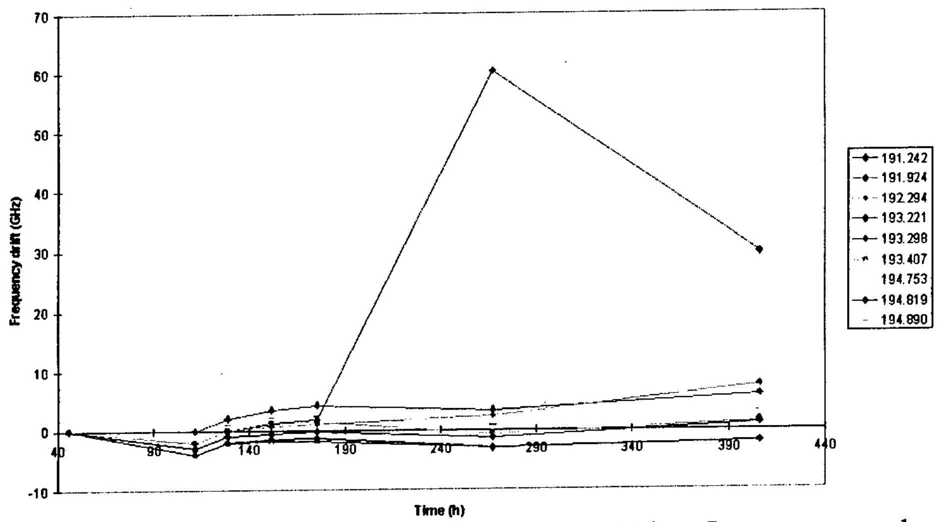

Figure 6. frequency drift of 8 wavelengths for a single Altitun Laser measured over 440 hours at a chip temperature of 85° C

Personnel Supported

Ph.D. Students: Lavanya Rau
Research Engineer: Laurent Dubertrand
Faculty: Daniel J. Blumenthal

Publications: None

Interactions/Transitions:

- Interaction with Prof. Larry A. Coldren at UCSB in terms of packaging tunable lasers and lifetime testing lasers fabricated at UCSB.

New Discoveries, inventions or patent disclosure: None

Honors/Awards:

- ONR Young Investigator Program (YIP) award
- Senior Member of the IEEE.

Work to be performed in the next year:

- Continuing 5000 hour lifetime test of 10 Altitun GCSR lasers
- Potential integration of 2 UCSB SGR lasers (ONR sponsored) into lifetime testbed
- Evaluating and analyzing potential degradation mechanisms of resulting lifetime testing
- Feedback of analysis and evaluation to NRL and laser design, process and manufacturing cycle.

Results to Date

The testbed is designed to measure tunable laser characteristics in an accelerated aging environment. These characteristics include the wavelength tuning repeatability and wavelength vs. current tuning curve, the output power as a function of wavelength, laser threshold as a function of wavelength, sidemode supression ratio (SMSR) as a function of wavelength and laser linewidth as a function of wavelength

A schematic of the lifetime characterization testbed is illustrated in Figure 1. Shown are from top to bottom, the computer for measurement control and data acquisition. Acquisition is performed using GPIB while laser control is performed through an RS232 bus. An uninterrupted power supply (UPS) is used to prevent data and laser loss during power outages, brownouts and spikes. An internal 1 Gbyte removable media cartridge is used for scheduled data backup. The lasers are housed in a 10-laser mainframe. Each laser is mounted in a butterfly package on a PC board. Each PC board has a controller that sets currents for 4 laser sections and the temperature of the laser package. These parameters are controlled using RS232 commands at the board input. The mainframe provides power to the 10 boards as well as a switched RS232 bus to allow communications to any laser using only one RS232 connection to the computer. Optical characteristics are measured by using a 1x12 optical switch to connect one laser at a time (under computer control) to the optical spectrum analyzer. A photograph of the lifetime characterization testbed is shown in Figure 2.

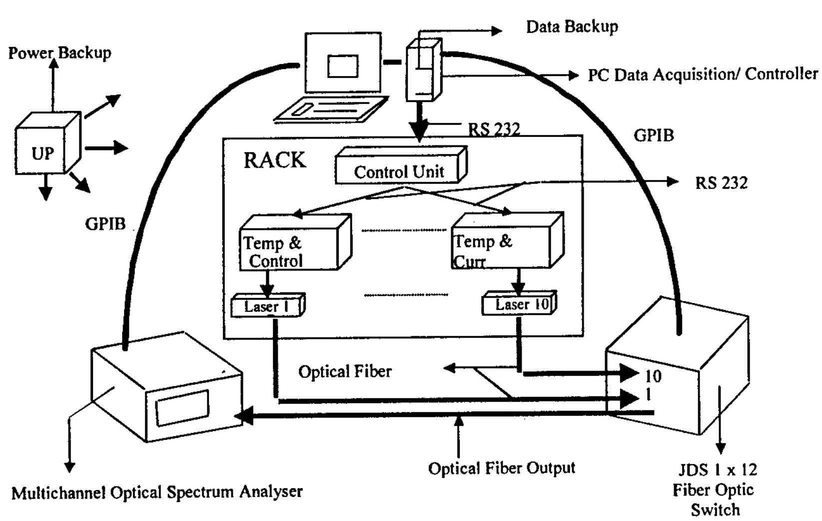

Figure 1. Schematic of tunable laser accelerated aging testbed.

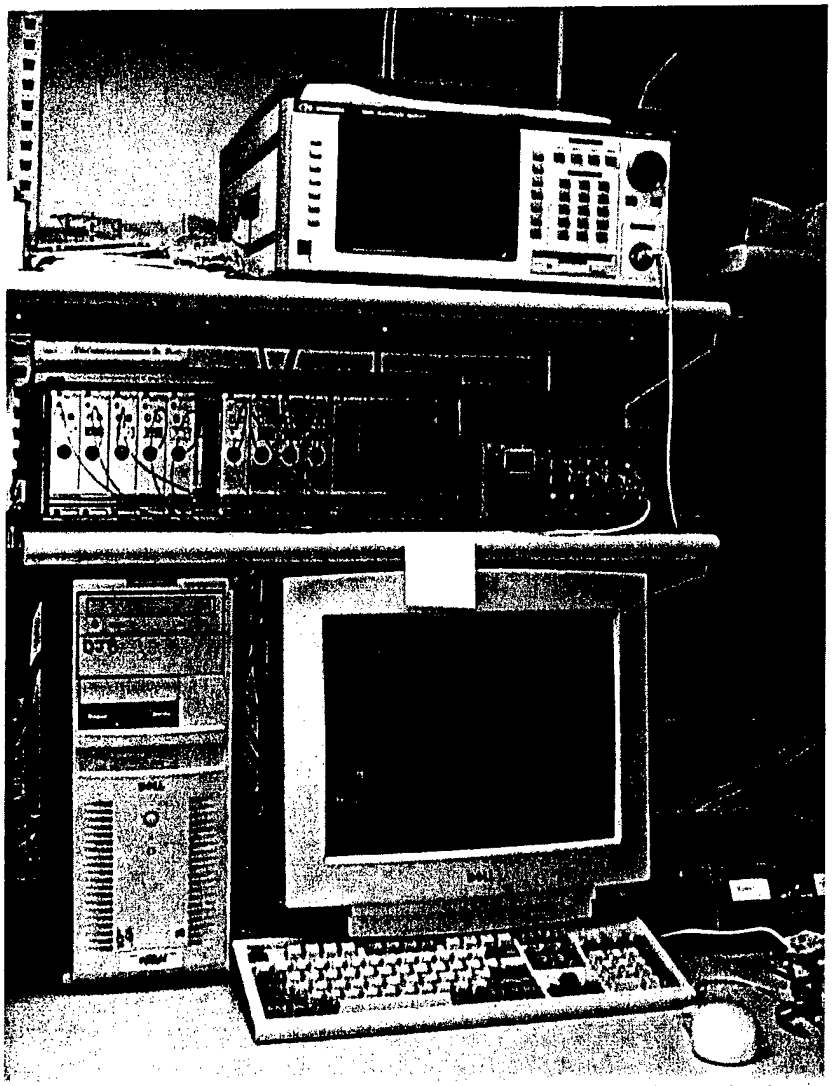

Figure 2. Photograph of laser aging characteristic testbed.

A close-up of a single channel Altitun GCSR laser module for the 10-card mainframe is shown in Figure 3. Current control for each of 4 sections of each laser and temperature control is performed by onboard circuitry controlled through the RS232 mainframe bus. Preliminary measurements of frequency deviation (scale is 12 GHz/div) for each of 40 wavelengths of a single Altitun laser module taken over 60 hours is shown in Figure 4.

Preliminary extrapolation of frequency drift for 8 wavelengths in a single Altitun laser out to 100,000 hours obtained from 60 hour data shown in Figure 5. The actual frequency drift of 8 wavelengths for a single Altitun Laser measured over 440 hours at a chip temperature of 85° C is shown in Figure 6.

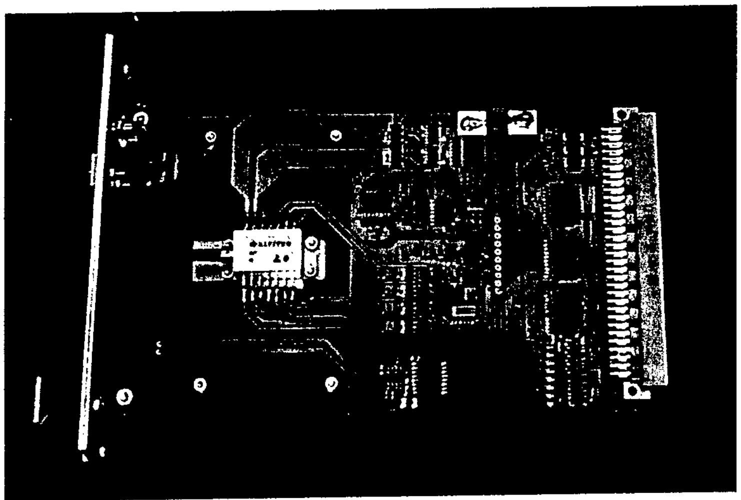

Figure 3. Closeup view of GCSR laser module.

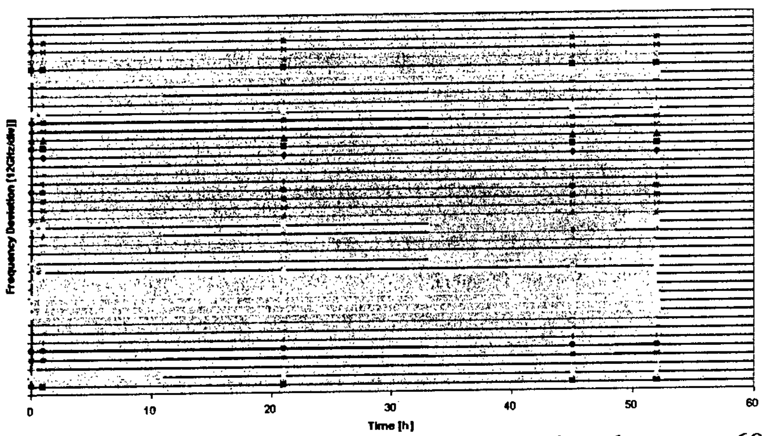

Figure 4. Frequency deviation for each of 40 wavelengths taken over 60 hours at 65 degrees Celsius.

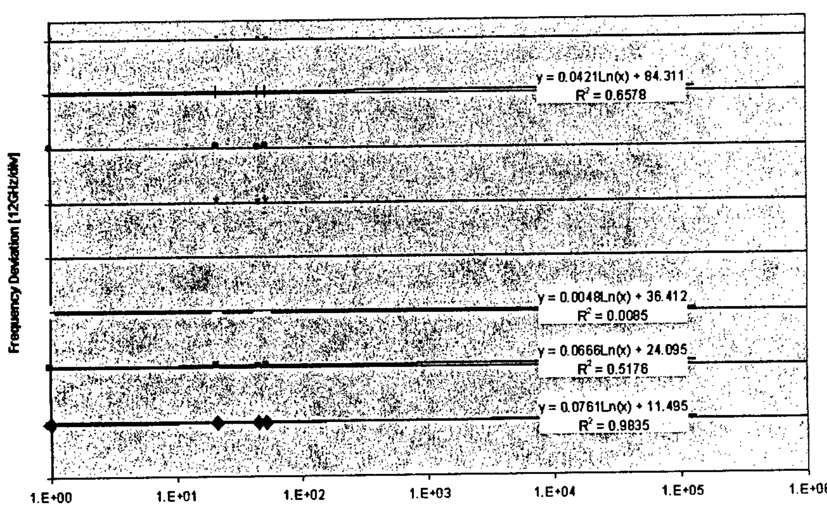

Figure 5. Frequency drift for 8 wavelengths extrapolated out to 100,000hours.