STROBE LIGHTING DEMONSTRATION
AT ST. MICHAEL, ALASKA

A FINAL REPORT

Report by: Ronald E. Miller, P.E.
and Dana Pruhs

State of Alaska
Department of Transportation and Public Facilities
Statewide Research Section
and
Western Region of Planning and Programming

APRIL 1980
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ACKNOWLEDGEMENTS

The Alaska Department of Transportation and Public Facilities (DOTPF) gratefully acknowledges the support and cooperation received for this project from the Alaska Air Carriers Association, Munz Northern Airlines, Ryan Air Service, the village of St. Michael, and Mr. I. L. Valley, president of Valley Illuminators.
INTRODUCTION

Of the more than 200 airports throughout Alaska recognized by the Federal Aviation Administration (FAA) only a few are equipped with lighting systems and/or navigational aids. In general, these unlighted facilities tend to be rural or bush airports serving small communities with relatively light air traffic demands, and are suitable for use only by single engine or light twin engine aircraft.

However, for the residents of many rural communities their airport, for much or all of the year, represents the only viable transportation link to other parts of the state. The fact that lighting and/or navigational aids are limited or nonexistent at these airports decreases their useful service, due to weather and darkness, and increases the remoteness of the village from the standpoint of commerce and personal travel in and out. It is perhaps a bitter reality of the Alaskan experience that many people who are the most dependent on air transportation for the amenities and necessities of life are deprived of modern airport facilities of which lighting systems and various navigational aids are a vital part. Yet the economic realities of such systems in the face of Alaskan logistics, operation and maintenance costs have permitted only slow progress in facility improvements.

In an effort to initiate a resolution to these problems, Mr. Richard Holden, former Deputy Commissioner for Planning and Research, upon request of the Legislative Affairs Agency directed the formulation of two research projects. One was to investigate the development of a high reliability power system for rural airport lighting (which is discussed later) and the second, which is the subject of this report: the investigation of a strobe lighting system as an alternative to conventional airport lighting systems.

The overall intention was to study the possibility of developing both alternative lighting and power systems which could satisfy FAA requirements while providing less costly and more maintainable systems for rural application. Since the FAA and DOTPF Division of Aviation, in cooperation with Valley Illuminators, conducted an informal experiment with portable strobe lights at Big Lake Airport on Sept. 6, 1978, it was considered appropriate to make a more permanent installation of a strobe lighting system and study its adaptability and reliability over an extended test period: see Appendix A. The results of that study are described in this report.

The study location was selected as St. Michael, Alaska, a village served by a typical bush airport and having a suitable power source available near the runway. St. Michael is situated on Norton Sound 140 air miles southeast of Nome in western Alaska (Figure 1) and has a stable population of over 300 year-round residents, with fishing as the major industry. The runway is a 2,000-foot long, 50-foot wide, gravel surfaced facility running generally North/South over flat terrain and is connected to the village by a ½-mile gravel road. Both sides of the runway are marked by having reflectorized illuminators spaced at 200-foot intervals along each edge.
There is a lack of developed land transportation in the St. Michael area and access via water transportation on Norton Sound is gained only during the months of June, July, August and September. The remaining eight months St. Michael is icebound making air transportation the only viable link to other communities.

The village is presently served on a scheduled basis by Ryan Air Service on subcontract from Wien Air Alaska for delivering mail and providing air taxi and freight services. Several air charter services operating out of Nome and Unalakleet also serve St. Michael on a nonscheduled basis. All services are limited to light twin engine or single engine aircraft, and the airport averages 100 to 135 operations per month. The airport is maintained on contract by DOTPF using one John Deere Model 450 track dozer for snow removal and grading purposes.

This report presents a summary of the performance of the selected lighting equipment, operational comments and recommendations made by the pilot/users, and conclusions made based on findings of this study. Included in the conclusions are recommendations made in a report that was completed by CH2M Hill for DOTPF concurrent with this study. From the foregoing, an implementation statement is developed.
LIGHTING EQUIPMENT

A Whelen model 360-WSA Strobe Lighting System was selected for this project upon the recommendation of Mr. O. Alexander Hoke, Research Analyst for the Legislative Affairs Agency: see Appendix B. System specifications for the model 360-WSA are as follows:

Flash Energy: 15 joules per flash
Luminous Intensity: 1,200 effective candlepower per flash
Flash Rate: 80 flashes per minute per light
Strobotron: 4321-A Xenon Flash Tube in a Lexan Optic Dome
Flash Tube Life: 1,200 to 1,500 hours
Power Requirements: 45 watts, 117 volts A.C.

The system sequencing is controlled by a Whelen model WSE2 Sequence Control Unit. The strobes have 360 degree visibility and are covered by split color domes (180 degrees amber, 180 degrees clear).

Cost of Lighting System

1. Unit cost (entire system) $1,900.00
2. Installation cost (one electrician) 750.00
3. Maintenance and operation
   A. One year supply of electricity at an average of 12 operations per month 425.00
   B. Replacement cost
      (1) Stobe (complete unit) (each) 220.00
      (2) Strobe light bulb (each) 30.00
      (3) Electrical cable (per foot) .50
   C. Electrician call out for repairs including transportation 750.00
INSTALLATION

The Whelen Strobe Lighting System was purchased from Valley Illuminators of Tukwilla, Washington in March 1979. Plans were made to install the system in early April, but due to delays by Ryan Air Service in installing a VHF radio at St. Michael, the system was not operational until November 14, 1979.

The configuration of the system (Figure 2) was controlled by three factors - the length of wiring (cables) supplied by Valley Illuminators, space limitations at the airport, and the location of the Alaska Village Electric Cooperative (AVEC) power source - which necessitated locating the installation on the southern approach to the airport. Seven man hours were needed to make the installation, and a John Deere Model 450 dozer was used to excavate a ditch in order to bury the system's interconnecting cables.

The purchased system included five strobe lights with split colored domes (clear marking the approach side, amber facing the runway side), complete wiring and a sequence controller. The strobes were set on a straight line 35 feet apart on the southern approach centerline to runway 18-36 with the last strobe placed 100 feet from the end of the runway (threshold). The system was manually activated by an on/off switch at the power meter. When activated, the flashing sequence began at strobe 1 (farthest from the threshold), followed rapidly by strobes 2 and 3, and then strobes 4 and 5 (nearest to the threshold) flashed in unison to end each sequence. The flashing continued to be repeated in that manner until the system was manually turned off.
OPERATIONS AND USER ANALYSES

Mr. Leo Kobuk, station manager for Ryan Air Service at St. Michael, was the person designated to turn the strobe system on and off. The system was activated only when Mr. Kobuk received a call over his VHF radio (on frequency 122.9 megahertz) from an incoming aircraft pilot requesting the strobes be turned on. The pilot placed this call 5 to 10 minutes prior to his aircraft's estimated time of arrival at the St. Michael airport.

For the study period the strobes were used 12 to 15 times per month or during an average of 11% of each month's total operations. Most of the system's use occurred during periods of low visibility weather conditions (white-outs caused by snow and blowing snow), rather than during periods of darkness. Pilots reported that the strobes could be seen from a distance of 20 miles when visibility was good, and from 1 to 2 miles during poor visibility conditions, and that the runway alignment could be ascertained when the aircraft was approaching at 45 degrees to the runway centerline. Ryan Air Service was the only operator to use the system.

Ryan's pilots commented that the strobes were spaced too close to each other and that the lights were too bright. The brightness of the lights tended to disorient the pilot because of the resulting glare on the aircraft windshield. Furthermore, after passing the last strobe (100 feet from the threshold) on final approach to runway 18-36, the pilots reported having the problem of their eyes not being able to readjust fast enough to the darkness of the runway (night blindness) causing them to touch down a greater distance beyond the threshold than normal. This readjustment problem also caused the pilots to be unable to see several of the edge reflectorized illuminators prior to touchdown. Without the strobe lighting the pilots normally see the edge illuminators when, at an altitude of 50 feet above the runway, the aircraft landing lights begin to illuminate the reflectors. The overall opinion of the pilots who utilized the system was that the strobe configuration must be modified if this type of system is to be accepted as a safe alternative to the standard FAA approved lighting system.

The system was removed on April 3, 1980. During the 4½ month study period the system was fully functional (no breakdowns), nor was there any damage to the system from vandals. The reliability of the system was not fully substantiated because of the limited use the system received during the study period.
USER RECOMMENDATIONS

Mr. Wilfred Ryan, owner of Ryan Air Service, made the following recommendations:

1. Place the last strobe that is to be passed over on final approach at a distance of 1,000 feet from the threshold.

2. Place the aligned strobes at least 500 feet apart.

3. Replace the last two strobe lights that flash in unison with two low intensity, green threshold identifier lights set at the corners on the approach end of the runway.

Mr. Ryan and his pilots felt that these recommended changes would reduce the glare/night blindness problems and allow for better threshold identification.

Comments by the FAA were made after their preliminary review of the aforementioned Big Lake demonstration and are presented as Appendix C. The FAA was also invited to review and comment on the installation at St. Michael by DOTPF personnel. FAA declined the invitation expressing the view that they would stand on their original comments offered subsequent to the Big Lake demonstration.
CONCLUSION

The St. Michael study established that the installed system of strobe lighting was not an acceptable alternative to the standard FAA approved airport lighting system. Although the use of the strobe lighting system helped with runway alignment orientation, the system is not, by itself, suitable for night operations. Both the commercial air carriers and FAA concur on this point.

The FAA's minimum requirements for Airport Development Aid Program (ADAP) funded airports that are to be used during the hours of darkness and periods of low visibility weather conditions by commercial operators under visual flight rules (VFR) are as follows:

1. Steady running edge identifier lights spaced at 200-foot intervals along both sides of the runway.
2. A visual approach slope indicator system (VASI).
3. Runway end identifier lights (REIL) on the threshold.
4. Rotating beacon.
5. Lighted wind cone.

Even if a strobe system was installed in conjunction with these standard systems, proper strobe spacing and intensity would be subject to meeting FAA guidelines in order to receive ADAP funding. When the State receives ADAP funding for an airport, the State is required to make the commitment of adhering to all FAA rules and regulations which apply to that airport and any improvements made to it for 20 years following receipt of ADAP funding. If improvements are made, with which the FAA does not concur, a prorated amount of the original ADAP grant must be repaid by the State. Furthermore, it is essential from an accident/liability standpoint that the State's bush airports be operated to acceptable and safe standards; FAA standards as applied to safety are the bulwark of the aviation industry.

Having concluded that an FAA approved lighting system is the only system which is accepted as fiduciary, at present there is not a suitable alternative to an FAA approved system. FAA's requirements which apply to night operations at bush airports could, however, be adapted to Alaska's unique environment, and the FAA is more than willing to work with the State toward that end: see Appendix D.

Concurrent to this study, a report was completed by CH2M Hill for DOTPF in which various power sources were examined for functional and economic aspects when used to power an airport lighting system. CH2M Hill's report "Feasibility Report and Design Guide for Remote Airport Lighting Systems" recommends that the State proceed with the prototype development of a rural airport power system using the Organic Rankine Cycle generator to power a conventional airport lighting system.
IMPLEMENTATION STATEMENT

This report completes the analysis and investigation phases of the research requested by the Legislative Affairs Agency. The next phase will be to take the findings of this report and, coupled with the recommendations made in CH2M Hill's report, develop a demonstration project: see Appendix E. Though implementation of the recommended systems and evaluation of their effectiveness, a more reliable, economical and safe airport lighting system for rural Alaska might be established.
REFERENCES


APPENDIX A
TO: John Bates, Director  
Research and Development  
Department of Transportation  
and Public Facilities

FROM: Richard A. Holden  
Deputy Commissioner  
Planning and Research  
Department of Transportation  
and Public Facilities

DATE: February 8, 1979

SUBJECT: Bush Airport Lighting

Last fall we conducted some informal experiments at Big Lake Airport with portable strobe lights as a means of providing directional lighting to a small airport. The need for such systems is obviously great.

Please establish a research project to identify the various kinds of systems and hardware which could be used to light small airports in rural areas. You should coordinate this effort with Bill Hueners and with Pat Ryan’s people. The results of such investigation should be available for evaluation by August of this year to be incorporated, if applicable, in the FY 81 Capital budget.

CC: Jessie Dodson  
Robert W. Ward  
Ray Shumway  
Bill Hueners  
Dennis Dooley  
Robert L. Faith, F.A.A., Anchorage  
Thomas H. Wardleigh, F.A.A., Anchorage
TO:  John Bates, Director  
Research and Development  
Department of Transportation and Public Facilities

FROM: Richard A. Holden  
Deputy Commissioner  
Planning and Research  
Department of Transportation and Public Facilities

DATE: February 27, 1979
FILE NO:
TELEPHONE NO:
SUBJECT: Strobe reflector airport lighting

I recently instructed you to develop a research program to develop a lighting system for small rural airports. Attached you will find a memo from Bill Hueners to Pat Ryan dealing with the same subject. Additionally, Riley Snell has contacted Aviation Design and Construction on the subject. In this instance, apparently great minds do think alike.

It shall be your responsibility to orchestrate this unit's participation in the development of a small airport lighting program. Bill Hueners has identified a source of funding for the project and I have no specific desire that we play the lead role. You should therefore work with Bill to develop a certified work plan such that our participation is regularized.

cc: D. Dooley  
  Mort Cook  
  Maurice Wilson  
  Bob Thomas  
  Riley Snell  
  Ray Shumway  
  Bill Hueners
Per your request of February 8, 1979, the following approach to developing a Bush airport lighting system is proposed.

1. Install a strobe system at a Bush strip similar to the one tried at Big Lake. This installation will be used to determine the operational reliability of the strobe system. This installation will be funded using $15,000 worth of Research and Development bond funds, and Design and Construction, Aviation, will design and assist Maintenance and Operations on the installation of this facility. Planning will develop a report on the operation of the system.

2. Develop an alternate energy source capable of providing power to a minimum FAA approved lighting system. This energy source will be needed to power lighting systems which have no reliable source of energy. R & D will use approximately $40,000 to hire a consultant to develop this system. D & C, Aviation, will provide technical support to this development project. Planning will select and fund a site for R & D to install a prototype system in order to test the system's operational reliability. R & D will monitor and develop a recommended alternate energy system for statewide use.

This concept was discussed and agreed upon in a meeting held on March 5, 1979, with Messrs. Hueners, Bates, Miller, Snell and Birkland in attendance.

Barring any unforeseen problems, the strobe system should be operational within a month.

Unless otherwise instructed, R & D will proceed with implementation of the procedure outlined above.

cc: Jessie Dodson, Special Assistant to the Governor
Clayton Hueners, Director, Aviation Design & Construction
Windy Miller, Maintenance & Operations
Riley Snell, Regional Planner, Nome
Dennis Dooley, Director Transportation Planning
With these suggested modification I feel that this lighting system would be very valuable, useful and safe, as well as economically feasible.

Sincerely,

Steve Ransom

Steve Ransom
Clayton C. Hueners, Director  
Division of Aviation  
Design and Construction  
Department of Transportation  
and Public Facilities

Subject: Big Lake Airport Lighting System Demonstration Project:

Sir:

As pilot of the Anchorage Airways Cessna 206 flying the lighting system, I have some comments.

As the system alternatives were demonstrated, sequential flashing of the lead in strobes was the most beneficial method of gaining approach orientation. Random flashing of the lights lead to confusion. However, as the system was set up runway alignment was poor until sighting of the runway deflector was made from the aircrafts landing lights at about 200' elevation and 1/4 mile. Upon sighting of the reflectors orientation & perception was excellent, with definite identification of threshold & runway edge.

Improvement of the system requires better lead in alignment lighting. This I feel could be attained by extending the spacing of the sequential lead in strobes from the demonstrated 100' intervals to 200' or 250' intervals in a series of 3 to 5 lights.

The strobe runway end identifier lights were not necessary with threshold reflectors installed. The strobe REIL tends to force the pilot to cross the threshold at a higher altitude than safely necessary due to the bright distracting strobes causing useless waste of available runway.

An effective alternative to the strobe REIL would be to replace them with low to medium intensity steady burning green identifier lights at runway side. An associated beam of light at the threshold aimed at the first few runway edge reflectors should also prove effective for runway identification on extended final approach prior to aircraft landing light reflection.

To activate the lighting system a series of mike keys on a specified frequency such as 122.8 may be practical.
October 11, 1978

Mr. Robert D. Judd
Chief, Flight Standards
Federal Aviation Administration
Alaska Region
632 West 6th Avenue
Anchorage, Alaska 99501

Dear Bob:

Although it's a little late I did want to thank you and your people for taking part in the lighting demonstration project at the Big Lake Airport early in September. Although I am sorry that you were not able to land nor take part in the full evaluations and discussions we held on the ground with the State DOT people, I am sure you were able to make a fair evaluation by your many fly-overs. I would appreciate having an evaluation from you and your written observations. The project was very valuable to me and, I'm sure, to Mr. Valley in that we were able to make some changes to the original idea and evaluate it as the evening went on. I am truly sorry you were not able to stay with us during the entire demonstration because at the end, following several flights with our aircraft, we were able to demonstrate what I think is a very feasible airport marking and lighting system of great use here in the State of Alaska.

I am enclosing for your information the comments from our pilot, Steve Ransom, which I believe to be a very fair evaluation of what we discovered.

Again, I greatly appreciate your taking the time to participate and hope that I may have your comments.

Sincerely,

ALASKA AIR CARRIERS ASSOCIATION, INC.

James M. Dodson Jr.
Executive Director

cc: Honorable Quentin Taylor, Deputy Administrator, FAA
    Mr. Don Keil, Acting Director, Alaska Region
    Mr. Bill Hueners, Alaska DOT
    Mr. I. L. Valley
Attached are copies of comments received on the Big Lake Airport demonstration project conducted last fall. I was led to expect there would be more feedback, but apparently this is it. Based on what has been observed, it is considered appropriate to make one or more permanent installations for an extended test period. Such installations could provide information from a number of aircraft operators and identify any unusual maintenance needs.

There is funding in the 1976 G.O. Bond Program for unspecified projects in the "Northwestern Region" which I suggest be used for this purpose. The airports selected for such an installation should have reflectors, power reasonably close to the end of the runway, clear approaches and relatively flat terrain extending beyond the runway end a minimum of approximately 500'. Significant traffic, runway maintenance suitable to support nighttime operations and vandalism potential are also considerations. Using our own forces for the bulk of the work, it is our expectation that the cost per installation will be under $10,000.

We would plan to provide a system which can be activated by keying the aircraft mike to conserve power and bulb life.

Sites which appear to be good possibilities are Noorvik, Huslia, Kivalina, Wales and Noatak. This reflects some coordination with your staff. At this stage I would like to get tentative agreement on several locations. We will then proceed to work out details prior to a final determination on number and location of installations. I expect this will be a topic of discussion at the Alaska Air Carriers Association meeting February 22, and it would be good to have a fairly firm proposal in mind at that time. Please advise if you wish us to pursue this.

Attachments

cc: Ray Shumway
    Dick Holden
    Windy Miller
    Roger Head
Bill Hueners, Director
Division of Aviation Design and Construction
Dept. of Transportation and Public Facilities
Aviation Building, Pouch 6900
Anchorage, AK  99502

Dear Mr. Hueners:

During recent discussions with Dick Holden, Jim Eberhardt and Don Fischer of the Department of Transportation and Public Facilities and with legislative representatives Nels Anderson, Alvin Osterback and Leo Schaeffer, various alternatives to standard runway lighting systems were discussed vis a vis the legislative interest expressed this session in a statewide upgrade in rural airport lighting. CSHB 787 (attached) identifies 107 airports in need of runway lighting as an aid to air navigation. Information used in compiling this list of airports has come from a survey of rural communities and Alaska air carriers, as well as personal requests of legislative members. Obviously the $16,007,220 bond amount proposed in CSHB 787 for the installation of standard runway lighting at the sites listed is prohibitive.

Consequently, an alternative to standard lighting has been sought in the interest of reducing the overall cost of a statewide lighting program and in hopes of more nearly tailoring the lighting configurations to the needs of specific airport sites. In our discussions, Mr. I.L. Valley of Valley Illuminators in Tukwila, Wash., has served as our technical advisor. Mr. Valley has proposed an assortment of configurations using the Whelen lighting systems (copy of Whelen brochure attached) to complement the illuminators presently installed at over 130 airports in rural Alaska.

The rationale of Mr. Valley's proposal is that the lighting requirements of (1) runway location and (2) approach alignment can be met by complementing the existing illuminators with a sequence of low-power strobe lights placed at one end of the runway rather than replacing the existing illuminators with a costly standard runway lighting system with its relatively high power demands and maintenance costs. Alaska air carriers have repeatedly extolled the virtues of the illuminator system as a very efficient, reliable and cost worthy runway perimeter demarcation system once the aircraft's landing lights are aligned with the landing surface at approach slopes.
The intent of this proposal, therefore, is to provide an economical solution to the problem of locating the field, determining the proper runway alignment and identifying the runway threshold.

The Whelen Model WSB-500 or WSB-250 airport strobe light beacons (or their equivalent) seem to be the answer to the airport location problem for most rural airports requiring a lighting aid for identification. The WSB-500 provides long range identification at $500 per unit while the short range WSB-250 beacon costs $235 per unit. The power supply for each model is included in the unit cost and is available for 117 volt and 230 volt AC, and 12 volt or 24 volt DC.

Runway alignment and threshold identification, on the other hand, may be satisfactorily implemented by installing sequential approach strobe lights according to the configuration displayed on the attached Proposed Runway Lighting System Layout. In this diagram, the small green circles represent the standard pattern of retro-reflective illuminators presently in use at many rural airports maintained by the state.

The larger red circles superimposed on "X"s denote Whelen Model 360-WSA strobe lights or model 360-WSA split color strobe lights firing either at random or in sequence under the control of a Model WSEQ sequence control unit. Due to the incremental costs of each strobe light and the sequential control unit, two projects of four configurations are proposed for the initial pilot projects, in order to evaluate the increase in utility of adding elements to a skeletal system.

**Project 1:** Strobe light type = Model 360-WSA (clear lenses)

<table>
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<th>Firing Mode</th>
<th># of Lights</th>
<th>Pattern</th>
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<tbody>
<tr>
<td>Sequential</td>
<td>5</td>
<td>&quot;T&quot; (3-2)</td>
</tr>
<tr>
<td>Sequential</td>
<td>3</td>
<td>Linear (3)</td>
</tr>
<tr>
<td>Random</td>
<td>5</td>
<td>&quot;T&quot; (3-2)</td>
</tr>
<tr>
<td>Random</td>
<td>3</td>
<td>Linear (3)</td>
</tr>
</tbody>
</table>

These four approach strobe light configurations can be tested at a single site by simply switching in or out the two threshold strobe lights while simultaneously enabling and disabling the sequential power control unit. The linear (3) formation is suggested as a test pattern in order to ascertain whether or not the initial string of six reflectors adequately identifies the runway threshold without the use of two threshold strobe lights.

Project 2 follows the same strobe light numbers and patterns as Project 1 using Model 360-WSA split color strobe lights to determine the efficacy of a two-color system. Approaching the field from one direction, the flashing strobes would appear a given color (e.g. green) indicating that
the lights are located at the approach threshold of the landing surface. Approaching from the opposite direction, the flashing strobes would appear a different color (e.g. white) indicating to the pilot that the lights are located at the far end of the landing surface.

Each project requires the sequential control unit at $500, plus five 360-HSA strobe lights at $200 each. Project 2 requires split color fresnel lenses at an additional cost of $5 per light. The installation of sequential strobe systems entails the use of two #14 gauge wires for power input, two #18 gauge wires for control and a separate #18 gauge trigger wire to each unit. Spacing of strobe units is estimated at between 150 ft. and 200 ft.

Since the problem of determining the appropriate power sources for remote sequential strobe systems necessitates considerable preliminary research, it is hoped that two suitable sites with available electric power can be found for the initial pilot projects. In this way, Phase 1 of the following 4 part feasibility study can be implemented with the shortest delay.

Phase 1 - Analyze the functional aspects of the linear (3) and "T" (3-2) patterns of strobe lights fired at random and in sequential mode using clear fresnel lenses in Project 1 and split color lenses in Project 2.

Phase 2 - Investigate alternatives in switching devices.
A. Manual switching
B. Photo cell switching
C. Automatic clock times
D. Remote actuated switching using radio signals from aircraft

Phase 3 - Identify alternative power sources--examine functional and economic aspects of each.
A. Available electric power
B. Diesel generated power
C. Battery storage - manual recharge
D. Battery storage - automatic wind-power recharge

Phase 4 - Based on findings of Phases 1 through 3, develop a proposal, including cost estimates, for installing lighting at those airports listed in CSHB 787 and any other sites, among state-maintained airports, found to be deficient in runway lighting.

Considering that a significant investment has already been made in the retro-reflective illuminators at over 130 airports, and given the legislative interest in seeking improved runway lighting for purposes of
public safety and air transportation efficiency throughout the state, cognizance of the limited funds available for capital improvements of airports leads to the conclusion that a lighting plan which incorporates the existing illuminators deserves careful evaluation.

This proposal has several advantages over a plan to install standard runway lighting systems: (1) Duplication of effort would be obviated since work already done to install the reflectors would not be wasted. (2) The savings of installing the low-power sequenced strobe lights at only one end of the runway over the cost of removing the existing reflectors and replacing them with standard runway lights down both sides of the runway (plus the cost of installing and housing a 10 KW diesel generator for primary or backup power) would permit the upgrade of runway lighting at a far greater number of airports for the same amount of money. (NOTE: DOTPF estimates of the cost of installing the standard lighting system, plus generators on a 2,500 ft. airstrip, range between $120,000 and $150,000.) (3) The sequenced strobe light/reflector system has the added advantages of being less susceptible to vandalism (reflectors are not quite as attractive to target shooters as lights and not so easily damaged), less costly to maintain, and should the power system fail, the reflectors will still provide emergency landing aid while the standard runway lights would be useless. (4) Moreover, the project completion time required for the installation of a standard runway lighting system far exceeds the time costs for the installation of the sequenced strobe system because of differences in scale and complexity. Consequently, the standard lighting upgrade program statewide would be greatly protracted relative to the sequenced strobe lighting system, thus delaying, possibly for years, desperately needed lighting improvements at many state-maintained airports.

We certainly appreciate your comments and suggestions regarding the implementation of these pilot projects.

Sincerely,

[Signature]

O. Alexander Hoke
Research Analyst

OAH:dh
Attachments

cc: The Honorable Nels Anderson
    The Honorable Alvin Osterback
    The Honorable Leo Schaeffer
    The Honorable Frank Ferguson
    Jim Eberhardt
    I.L. Valley
    James Dodson, Jr.
PROPOSED RUNWAY LIGHTING SYSTEM LAYOUT

Prepared by:
Legislative Affairs Agency
Research Division
27 June 1978
FORMATION - 3, 4

FIRING SEQUENCE

LINEAR - 3

FIRING SEQUENCE

1 2 3

x x x

Prepared by: Legislative Affairs Agency Research Division 27 June 1978
Mr. Clayton C. Huener, Director  
State Division of Aviation - Design and Construction  
Department of Transportation and Public Facilities  
Pouch 6900  
Anchorage, Alaska 99502

Dear Mr. Huener:

This responds to your request for feedback on the test installation of strobe lights in conjunction with reflector type lighting aids at the Big Lake, Alaska, runway.

On September 6, 1978, Samuel Parsons, AAL-620; Richard Bottini, AAL-ACDO-31; and Arthur Wells, AAL-251, flew a series of approaches to the Big Lake airport to view a test installation of strobe lights. The lights were placed on the east end of the Big Lake runway. Two strobes were placed at the runway threshold with three more strobes used to lead the aircraft to the threshold lights. These strobes were readily visible and did serve to identify the runway end. Alignment with the runway was somewhat more difficult. Approaching the strobes at an angle of approximately 45 degrees from the runway alignment, we were unable to determine how much of a turn would be required to align the airplane with the runway. This may have been due to the close grouping of the five strobes. The distance from the runway threshold strobes to the farthest strobe was 300'.

Once the airplane was aligned with the runway, the in-line strobes did show this alignment. We had expected the reflectors to be illuminated by the strobes but this did not occur.

Several approaches were made to the airport. Each time the approach was made to the dark hole between the threshold strobes, the trees would begin to show in the landing light about 250' above the ground. The runway outline as a darker spot in the trees would appear at about 200' above the ground. The reflectors begin to show as the airplane descends below 150' AGL. They begin to outline the runway at about 100' AGL. The reflectors were never visible throughout the full length of this 2600' strip. The landing lights would reflect only from a few of the reflectors directly in front of the airplane. No runway length information was apparent from the reflectors, and we could not determine the amount of runway remaining as we were flaring for landing. For these reasons we did not land. Standard runway lights by comparison allow
the pilot to see the runway outline from any point in the traffic pattern. (This is not true of all lights). They also provide a picture of the runway outline which allows the pilot to judge the percentage of the runway in front and behind him. Another feature of standard lights is that the runway outline provides some angular descent guidance that is totally lacking with the reflectors and strobes.

In summary, the strobes do provide identification of the airport and with better spacing along with a sequential firing arrangement could provide guidance for runway alignment.

The reflectors along the edge of the runway are inadequate. They allow the pilot to identify the runway edge about 25' to 50' before the landing lights begin to illuminate the runway itself.

Sincerely,

[Signature]

ROBERT G. JUDD
Chief, Flight Standards Division
MAR 2  1979

Mr. John Bates, Director
Research and Development
Alaska Department of Transportation
and Public Facilities
Pouch 6900
Anchorage, Alaska

Dear Mr. Bates:

A courtesy copy of Deputy Commissioner Holden's memo of February 8, 1979, "Bush Airport Lighting," was directed to the Federal Aviation Administration (FAA). We would like to offer the following information which may be of assistance.

All airport visual guidance and lighting equipment which is to be installed under the FAA's Airport Development Aid Program (ADAP) must be approved by FAA. Performance specifications and lists of approved airport lighting equipment and manufacturers are issued in the form of advisory circulars. The enclosed Advisory Circular Checklist (AD 00-2FF) provides the title and subject of all current advisory circulars. Circulars in the AC 150/5340, Airport Visual Aids, series, and the AC 150/5345, Airport Lighting Equipment, series, are of particular interest.

Our Washington office has also advised that a new advisory circular for a low cost omnidirectional runway end identifier lighting system is being developed and should be available during the next year.

The FAA's National Aviation Facilities Experimental Center (NAFEC) recently conducted a test program for marking and lighting of unpaved runways. Although the test program resulted in several recommendations, the visual aids and lighting equipment which were evaluated have not yet been approved by FAA. We have enclosed a copy of the NAFEC Technical Letter Report, NA-78-34-LR, for your information.

The FAA recommends that all Alaskan airports which are included in the National Airport System Plan (those eligible for ADAP) be provided with the following fundamental development: runway lights, taxiway lights, rotating beacon, visual approach slope indicators (VASI's), lighted wind cone, and apron flood lights. Runway end identifier lights (REIL's) are also recommended where a visual approach deficiency exists. The FAA will participate
in the installation of reflective runway and taxiway edge markers, and threshold markers, unlighted wind cones and segmented circles for eligible airports where night operations are not conducted. All of these systems and equipment are covered by advisory circular specifications.

We would be pleased to assist you in any way we can during your research project.

Sincerely,

[Signature]
ROBERT L. FAITH
Director

Enclosure
March 12, 1979

Subject: Visual Guidance and Lighting Systems for Small Airports in Rural Areas

Mr. Robert L. Faith, Director
FAA, Alaskan Region
P.O. Box 14
701 "C" Street
Anchorage, AK 99513

Dear Mr. Faith:

The Division of Research & Development within the Department of Transportation and Public Facilities has been assigned to assist in the development of a low cost easily maintained FAA approved visual guidance system for possible use at the state's many bush airports.

The problems which exist in accomplishing this task are not easily solved; but with a coordinated effort I am sure that an acceptable system can be developed. The Department's Division of Aviation, Mr. Clayton Hueners, Director, will be the lead division for the technical support of the development and the prime contact with your agency.

I appreciate your offer of assistance and am looking forward to working with you and your staff on this project.

Sincerely,

John C. Bates
Director

cc: Richard Holden, Deputy Commissioner, Juneau
Clayton Hueners, Director of Aviation Design & Construction, Anchorage
Riley Snell, Planning Manager, Nome
Mr. Jessie Dodson  
Office of the Governor  
Pouch A  
Juneau, Alaska 99811

Dear Jessie:

I surely appreciated the visit with you and Jay last week. I am hoping we can begin a period of much closer coordination between the State of Alaska, the Industry and Communities and the FAA in the implementation of essential airports, lights, navigation and communication facilities.

Reflecting upon the requirements for night air service, it is noteworthy that the $460,000 will make a very sizeable budget to work with if it is applied toward ADAP funding rather than direct purchase of hardware. Both lighting aids and navigation aids are eligible for the federal matching fund program.

I will include Kalskag, New Stuyahok, Ruby, Sleetmute and Stebbins in our review for FY 1992 program requests. Unless there are major airport improvements at Elim, Shungnak, and Noatak, I am not sure that night operations would be a blessing. All three were very narrow, extremely soft and rough when I visited them last fall. Better suited for a helicopter than air taxi operations with an IFR light twin type aircraft.

I will look forward to meeting the study group when the time is right for them. By the way, if they want to travel to the places concerned, we can rent a suitable airplane and join them in a field survey. We have three pilots here, Jerry Bushnell, Fred Porter, and myself, all involved in the planning area and current in small aircraft so let us help as it is appropriate.

Sincerely,

[Signature]

Tom Wardleight
Flight Inspection Specialist
AAL-223

D-4
MEMORANDUM

TO: File X20111
    File X20119

FROM: Lee Leonard
       Acting Research Manager
       Statewide Research Section

DATE: April 3, 1980

FILE NO: 3201-X20111/X20119

SUBJECT: Meeting on Rural Airport Lighting in Alaska

On April 2, 1980 a meeting was held at the DOTPF research office in
Fairbanks for the purpose of discussing current projects involving develop-
ment of power and lighting systems for rural Alaska. Attendees were as
follows:

Mr. Al Bruck, Chief of Airway Facilities Division, FAA
Mr. Jerry Bushnell, Chief of Aircraft Management Branch,
    Flights Standard Division, FAA
Ms. Kit Duke, Director of the Division of Planning and
    Research, Central Region, DOTPF
Mr. Rick Jurick, Research Engineer, Statewide Research
    Section, DOTPF
Mr. Lee Leonard, Chief of Energy and Buildings Research
    (Acting Research Manager), Statewide Research Section, DOTPF
Mr. Ron Miller, Chief of Systems Research, Statewide
    Research Section, DOTPF
Mr. Riley Snell, Assistant Planning Manager for the
    Western Region, DOTPF
Mr. Robie Strickland, Chief of Airports Division, FAA

A briefing was conducted to bring everyone up to date on the research
effort by DOTPF. General discussion centered around the mutual interests
and the delineation of responsibility of FAA and DOTPF concerning rural
airport lighting systems. FAA participants reiterated their dissatisfaction
with the strobe concept as a substitution for conventional lighting systems.

A desire for closer cooperation between FAA and DOTPF at the working
level was expressed by all.

FAA showed great interest in our research efforts and pledged future
support and cooperation at all levels. They also expressed a desire to
become directly involved with the proposed Noorvik Demonstration Project.
They wish to make it a joint project from both the monetary and tech-
nical involvement standpoint.

Subsequent discussions will be arranged to develop the particulars on
this suggestion.

LEL/dw

cc: Kit Duke
    Heinrich Springer

02-001A(Rev.10/79)
DATE: December 19, 1979

FILE NO:

TELEPHONE NO:

SUBJECT: Revised Program For Rural Airport Lighting

From: John Bates
Acting Deputy Commissioner
Planning & Research
Department of Transportation and Public Facilities

To: Ronald Lehr, Director
Division of Budget & Management
Office of the Governor

The Department of Transportation and Public Facilities requests a revision in legislative intent for the Runway Lighting and Navigational Aids project for which $460,000 of General Funds was appropriated in Chapter 80/SLA 79. It is understood by the Department that the navigational lighting that was to be provided for the 23 stated airports was strobe lighting. The Department of Transportation and Public Facilities requests that the legislative intent be changed to funding a development and demonstration project at Noorvik that will install a power system and runway lights and provide for testing of the system as well as monitoring the maintenance cost, effectiveness, and pilot and public response.

The use of strobe lights to identify or furnish light for airport navigation is strongly discouraged by the FAA. This is due to the strobe lights causing temporary loss of night vision on the part of the pilot. The State will get into a financial bind possibly if it establishes strobe lighting systems at airports on which federal ADAP money has been used within the last 20 years. When a grant is signed to receive ADAP funding for an airport, we also agree that any improvements to that airport within the next 20 years will meet with FAA approval and be in accordance with the master plan for that airport. If improvements are made that the FAA does not concur in, we are required to pay back a pro rated part of the original grant. That plus the State's liability in case of an accident due to temporary blindness caused by strobe lights appear to make a change in legislative intent desirable.

An alternate power system has been developed by the Department's Research and Development Section. Implementation and demonstration of the power system at the airport in Noorvik appears feasible to the Department. Installation of the power system, provision of runway lights and navigational aids and monitoring the results after implementation can be achieved within the $460,000 of general fund appropriation.

The cost estimate is broken down as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (000)</th>
</tr>
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<tbody>
<tr>
<td>Power System</td>
<td>80.0</td>
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<tr>
<td>Runway Lights and Installation</td>
<td>150.0</td>
</tr>
<tr>
<td>Total Estimated Cost</td>
<td>430.0</td>
</tr>
</tbody>
</table>

Your approval is recommended.