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PHASE I AGTC SURVEY
AIRPORT INTERVIEWS

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16. Abstract This report presents the results of interviews conducted with airport management and FAA tower personnel during a survey of nine U.S. airports. This survey was conducted in December 1971 and January 1972 as part of a nationwide Airport Ground Traffic Control (AGTC) requirement study. The AGTC System is defined as the system responsible for active runway control, taxiway control and ramp control between the terminal facilities and the taxiways. This report is made up of the informal notes taken during each interview or generated shortly thereafter, and of a composite summary of the views expressed during the survey.

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PREFACE

The work described in this report was performed under the Airport Ground Traffic Control (AGTC) Development Program. This program is being conducted at the Transportation Systems Center and is sponsored by the Department of Transportation through the Federal Aviation Administration, Systems Research and Development Service.

The purpose of the AGTC system is to facilitate the movement of aircraft through the airport runway/taxiway network. This system is experiencing problems of high controller workload, aircraft delays during peak hours and poor visibility conditions. These problems will only become more serious as operation levels increase and operating minimums decrease unless AGTC system improvements are developed. The objective of the AGTC Development Program is to develop and demonstrate the required system improvements.

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1.0 INTRODUCTION

Interviews conducted with airport management and FAA tower personnel at nine airports are one part of a survey gathering data to be used in a nationwide Airport Ground Traffic Control (AGTC) requirements study. The AGTC system is defined as that system controlling the vehicles in the runway/taxiway/ramp network of an airport. Table 1-1 presents the set of airports surveyed and can be characterized as: (1) spanning a range of traffic levels from 150,000 to 670,000 total annual operations, (2) spanning traffic mixes with less than 6% general aviation at O'Hare to Cleveland-Hopkins and Bradley with 55% and 62% respectively, (3) experiencing snow conditions (with the exception of Los Angeles International) and (4) having weather conditions below Category I in excess of the 57 hour yearly average at Cleveland Hopkins with a high of 230 hours at Seattle-Tacoma International. For convenience, a set of maps showing the terminals, ramps, taxiways, and runways of the nine airports has been included.

The survey consisted of one-day trips to each of the nine airports. Generally, the airport management was visited in the morning and the FAA control tower in the afternoon. Both groups were briefed on the program, and then a preplanned interview was conducted verbally. The interview questions are presented in Appendix A. These two questionnaires were used as general guides. The actual interviews tended to be conversational with a relatively free format. Informal notes were taken during the interviews and later expanded into a set of working notes. These working notes are presented in Appendix B and are summarized in Tables 2-1, 2-2, and 2-3.

Before proceeding with these summary tables, it should be noted that the accuracy of the picture obtained from an interview is the product of:

1. the form, emphasis, and sequence in which the interview questions are asked;

TABLE 1-1. AIRPORTS SELECTED FOR THE SURVEY

AIRPORT	TRAFFIC LEVEL Total 1970 Operations[1]	TRAFFIC MIX Percentage of General Aviation[1]	Snow	WEATHER Average Hours Per Year Airport Ceiling <200 ft or Visibility <1/2 mile[2]
Chicago O'Hare International	671,000	6%	yes	76
Los Angeles International	575,000	24%	no	143
Boston Logan International	328,000	35%	yes	97
Cleveland-Hopkins International	322,000	55%	yes	57
Detroit Metro. Wayne County	310,000	30%	yes	111
Greater Pittsburgh	294,000	35%	yes	86
Philadelphia International	274,000	30%	yes	94
Seattle-Tacoma International	163,000	33%	yes	230
Bradley International	155,000	62%	yes	135

2. the accuracy of the on-the-spot responses to these questions;

3. the accuracy with which the interviewer reflects these responses;

4. and perhaps most important, the pertinent questions left unasked.

Interview information, therefore, should be used with caution and primarily to gain insight rather than absolute answers.

2.0 SUMMARY

2.1 CAPACITY

Table 2-1 summarizes those portions of the interviews pertaining to airport capacity. The airports are ranked according to their total 1970 annual operations, starting with O'Hare on the left and proceeding to Bradley on the right. Within this ranking, the airports fall into three groups: O'Hare and Los Angeles International with 600,000 operations; Logan, Cleveland-Hopkins, Detroit Metropolitan, Greater Pittsburgh and Philadelphia International with 300,000 operations; and Seattle-Tacoma and Bradley with 150,000 operations.

Traffic growth at these airports from 1960 to 1970 varied from 40% at Bradley to 175% at O'Hare, with a median of 80%. The Department of Transportation has estimated that by 1982 traffic at these airports will have increased from 15% at Cleveland-Hopkins to 70% at Seattle-Tacoma, with a median of 30% over their 1970 traffic levels.[4]

O'Hare and Los Angeles have between 60 and 70 gates. Inbound flights into both airports frequently have to wait for gates. O'Hare has a formal staging area in the ramps, referred to as a penalty box, to accommodate these aircraft. The management at both airports want to increase their gate facilities, but Los Angeles International is meeting stiff resistance from the community. Both airports are landlocked, and it was thought that O'Hare's ultimate capacity would be dictated by gate space.

The five airports operating at 300,000 yearly operations have from 38 to 64 gates. One of the airports is nearing its gate capacity and another its runway capacity. Over the longer term, the remaining airports are split between becoming gate-limited and runway-limited. Expansion plans for these airports call for around 60 gates and up to as many as 117 gates in the long term. Community response to airport expansion varies for these airports from popular support to having their expansion plans opposed by local and state governments, as well as by the community.

TABLE 2.1 AIRPORT PROFILES/ CAPACITY

	Chicago O'Hare	L.A. International	Boston Logan	Cleveland-Hopkins	Detroit Metro.	Greater Pittsburgh	Philadelphia Int.	Seattle-Tacoma	Bradley Int.
Annual Operations 0 (Reference 3) 0 2 (Reference 4)	 244,000 671,000 876,000	 289,000 575,000 744,000	 194,000 328,000 437,000	 197,000 322,000 378,000	 166,000 310,000 396,000	 163,000 294,000 375,000	 163,000 274,000 366,000	 81,000 163,000 278,000	 111,000 155,000 231,000
t Number of Gates	About 60; mostly leased to the airlines	67; assigned to the airlines	64	40; mostly assigned to the airlines	49; mostly assigned to the airlines	38	45; assigned to the airlines	32; mostly leased to the airlines	13; assigned to the airlines
ty Limit of Present t Configuration	Gate limited at present	Gate limited at present		Gate limited with 30% increase in ops.	Runway limited with 10% increase in ops.	Gate limited at present	Runway limited at present	Gate limited at present	Gate limited with 30% increase in ops.
of Gates after d Expansion	Being worked out with airlines	Awaiting outcome of environmental study	Ultimate is between 85 and 94 gates	58;ultimately about 65; new gates leased	57; ultimately as many as 117	60 gates expandable to 105 gates	Present terminal expandable to 88 gates	52 gates in 1972; ultimately 62	24 in the short term; 50 in the long term
nity Response to sion Plans		Organized opposition	Stiff opposition from community and local and State governments	Some opposition	Some opposition	General Support	Support in Philadelphia		Unknown
ate of Airport's ate Capacity	Landlocked at 7500 acres;gate limited	Landlocked at 3600 acres		Landlocked		Expanding to 9000 acres; runway limited	Landlocked	Landlocked	Plans to increase airport acreage
nd Staging	Has a penalty box; occurs frequently	Occurs frequently		Occurs infrequently	Occurs infrequently	Occurs frequently and is a problem	Has a penalty box; occurs infrequently	Occurs frequently and is a problem	
und Staging ical Peak Departure ues; ging Caused by w Control	 5 aircraft; is a problem	 7 aircraft; occurred in past	 Does occur	 6 aircraft; Occurs infrequently	 5 aircraft; does occur	 5 aircraft; Is a problem	 8 aircraft; Is a problem	 None; occurs infrequently	
cal Intersections	Twy. Scenic/Rwy. 9L; Twy. Old Scenic/Rwy. 9L	Twy. 42J/Rwy. 7L; Twy. 47&49/Twy.K; Twy. L,P,R&T/Twy. 47; Twy. 3/Rwy. 25R	Twy.Sierra/Rwy. 4L; Twy. Charlie/ Rwy. 9	Twy. R/Rwy. 36	Twy. H/Rwy. 3R	One way link between intersection of Twy.L/Twy.N and Rwy. 28R	Rwy. 27/Rwy. 35	Twy. B8/Rwy. 34R	Twy. S/Twy. C
ne Ramp Towers	AA and UA	None	Two airline companies	None	None	Allegheny Airlines	None	None	None
Supervision	Present system is adequate at this time	Present system is adequate at this time	Present system is adequate at this time	Traffic in ramps is not a problem	Present system is adequate	Present system is adequate	An increasing problem	Present system is adequate	Airline companies do it now
for Second Ground r Local Controller on(s)	Local Controller-1966; Ground Controller-1968; reasons-controller workload & VHF channel saturation	Local Controller-1960's; Ground Controller - 1968; reasons - workload & VHF channel saturation; one G.C. now due to traffic slump	Ground Controller requested for 1972; reason-VHF channel saturation	Not for two years at least	Local Controller-perhaps by 1975; Ground Controller-perhaps by 1976; reason-VHF channel saturation	Local Controller-perhaps by 1974; Ground Controller-perhaps by 1975	Local Controller - an assistant (no freq.); Ground Controller - requested for 1972; reason-VHF channel saturation	No	No

Seattle-Tacoma has 32 gates for its 150,000 yearly operations and is presently operating near the limit of its gate capacity. This has prompted the building of 20 additional gates, which will be completed during 1972. The airport is small and landlocked and foresees an ultimate gate facility of 64 gates but no expansion of its runway facilities. Bradley has 13 gates and has not yet reached the capacity limit of its gate facilities. This is due to the facts that the airport traffic mix is made up to a large extent of general aviation aircraft and that the gates are not jetways and can therefore service more than one aircraft at a time. The airport's expansion guideline calls for 24 gates in the short term and 50 gates in the long term.

Inbound staging is common at those airports which are presently gate-limited -- four in number. Outbound staging is most frequently necessary to handle the daily surges of departing flights. The typical peak departure queue varies from no queue at Seattle-Tacoma to something less than ten aircraft at Philadelphia International, with a median of around five aircraft. Staging outbound flights due to flow control restrictions occurs with some regularity at five of the airports. The responsibility for sequencing the aircraft in the departure queue so that the various flow control takeoff restrictions are satisfied belongs to the ground controller.

Each of the airports has one or more critical intersections (critical in the sense that the controller's attention is frequently required). Critical intersections fall into two categories: (1) intersections with intersecting traffic flows, and (2) intersections which pilots tend to mishandle resulting in an unsafe condition. An example of the latter case is the intersection called out by Detroit Metropolitan, taxiway H and taxiway J, Figure 2-5. Aircraft approaching active runway 3R from the left on taxiway H and instructed to make a left turn onto taxiway J sometimes miss the turn and roll onto the active runway. To prevent this from occurring, the controller issues a precautionary instruction to the aircraft approaching the intersection and then watches to see if the proper turn is initiated. A similar intersection exists at Los Angeles International,

taxiway 42J and taxiway K, Figure 2-7. A blinking red edge light has been installed and has prevented any aircraft from inadvertently rolling onto runway 7L.

Ramp supervision typically consists of: (1) FAA tower issuing advisories to aircraft, concerning pushback clearance and to prevent nose-to-nose situations from occurring; (2) airport management policing the car and truck traffic in the ramps; and (3) possibly, certain airlines controlling their company aircraft in the vicinity of their concourses. The control of ramp traffic is fragmented, and full responsibility rests with individual pilots and drivers. In general, the present method of ramp supervision was thought to be adequate, although it was noted as an increasing problem at two airports. As an aid to controlling company traffic, airline ramp control towers have been constructed at three of the nine airports - O'Hare, Logan and Greater Pittsburgh.

One ground controller station adequately handled the traffic levels of these airports until the late 1960's. At that time, both O'Hare and Los Angeles International were handling over 500,000 yearly operations and were experiencing saturation of their ground controller stations. Saturation was in the form of controller workload and of overloading the single ground control communication frequency. This prompted both airports to institute a second ground controller station with its own communication frequency. At present, O'Hare does not expect the increasing traffic level to saturate its two ground controller stations; and Los Angeles International, operating at 550,000 yearly operations, has reverted back to using one ground controller due to the recent slump in traffic. Of the five airports operating at 300,000 yearly operations, two are currently requesting a second ground control station, and the other three expect to make such requests in the next two to four years. The reason given was VHF channel saturation. Seattle-Tacoma and Bradley each have a ground controller station and foresee no problems with that manning level.

2.2 SURVEILLANCE

Table 2-2 summarizes those portions of the interviews pertaining to surveillance, the process by which a controller identifies and tracks the vehicles for which he is responsible. At most airports, surveillance of airport surface traffic consists of whatever the ground controller can see from the control tower. Visual surveillance is best during the daylight hours in clear weather. Darkness and poor weather make it more difficult.

At night, the ground controller depends on both aircraft lights and the "shadow" of the aircraft against the background of taxiway/runway lights for tracking. He also relies on his VHF communication channel and flight strips for aircraft identification. It was estimated by the tower personnel interviewed that the ground controller's workload increases from 10 to 25% with the advent of darkness.

Loss of visibility due to weather not only increases controller workload, but also reduces the number of aircraft handled by the ground controller at any one time. As weather closes in and the surface of the airport becomes more obscure to the control tower, the ground controller maintains safety by permitting fewer and fewer aircraft to taxi at the same time. To make up for the loss of visual contact, the controller becomes increasingly dependent on pilot position reporting for tracking.

This mode of operation has been adequate at most airports, because the flow of surface traffic has always decreased sharply when the weather has dropped below the Category I landing minima. This situation is rapidly changing due to the FAA program to provide the nation's airports with the capability to conduct landings at progressively lower landing minima. Three of the nine airports surveyed have operational Category II runways, and four of the remaining airports are in the process of installing the necessary equipment and being certified for such operations. This program will require controllers to handle a regular flow of traffic under progressively lower visibility conditions.

TABLE 2.2. AIRPORT PROFILES/ SURVEILLANCE

	Chicago O'Hare	L.A. International	Boston Logan	Cleveland-Hopkins	Detroit Metro.	Greater Pittsburgh	Philadelphia Int.	Seattle-Tacoma	Bradley Int.
Weather Average Hrs./Yr. Ceiling < 200ft. or Visibility < 1/2 mile	76	143	97	57	111	86	94	230	135
Category II Runway Rating	For 14L & 14R	Planned	Planned	For 5R	For 3L	One runway being certified	9R is being equipped	16R is being equipped	Runway 6 being certified
Night Operations - Increase in Controller Workload	25%-Tracking & identification more difficult	10 to 15%-"strange" aircraft need more help	25%-tracking & identification more difficult	20%-increased vigilance	50%-increased vigilance	No more difficult than day operations	10 to 20%	20% - to maintain safety	Increases, but not a problem
Type of ASDE Display	Bright	PPI	Had a PPI	Had a PPI from 1963 to 1966	None	None	PPI	PPI	PPI
ASDE Availability	Good	Good		Good			Most of the time	Good	Good
ASDE Maintenance		Frequent and expensive	Contributed to unit being decommissioned						
ASDE User	Local Controller	Equally by Local & Ground Controllers	Equally by Local & Ground Controllers	L.C. > G.C.			Both Controllers	Equally by both controllers	G.C.>L.C.
ASDE Use	Weather	Weather	Weather & limited night usage	Weather and night			Weather & night	Weather & night	Weather & night
Estimated Use of a Good ASDE Bright Display	Night; limited day usage	Perhaps at night		No different than PPI	Weather	Weather	No different than PPI	No different than PPI	Of great benefit to Ground Controller
Estimated Use of an ASDE Bright Display with ID	Night; limited day usage	All the time	Desirable	Perhaps during the day	Not Sure	If it is good, perhaps all the time	No different than PPI	No different than PPI	Probably during the day
Visual Blind Spots to FAA Tower	A small one in twys. that won't hide a 707	No serious ones	Two in ramps and third one pending; new tower being built	No problem at present	Final approach to 21R-CCTV fix; a taxiway; tower to be raised 42 ft.	The turnoffs from 10L	The feeder taxiway to runway 17; new tower planned	The runup area to runway 16R; plan to raise the tower	3 small ones in ramps; 1 small one in taxiways

Based on ASDE Experience at Another Airport

Based on ASDE Experience at Other Airports

The current electronic surveillance system for ground is the ASDE II radar developed in the 50's by the Airborne Instruments Laboratory. There are twelve units in existence, eight of which are in operation and four of which have been decommissioned on cost-versus-benefit considerations. At two of the eight operational sites, a BRITE display has been provided in addition to the standard PPI display. Of the nine airports surveyed, one has an ASDE BRIGHT display, two have ASDE PPI displays, and two have ASDE PPI displays in a decommissioned status. In addition, two more airports have personnel with ASDE experience gained at other airports. The ASDE is used by the local controller primarily to monitor runway occupancy during poor weather. The local controller usually shares the ASDE with the ground controller, and it is not uncommon for the ASDE to be used during night operations. The tower personnel at O'Hare noted that the loss of resolution of their BRIGHT display relative to the PPI has reduced its expected usefulness. The availability of ASDE is good, but the system requires frequent and costly maintenance. In the general opinion of those interviewed, a high quality, BRIGHT, surveillance display would make surveillance easier, but it probably would not lead to the system being used any differently than the present PPI (i.e., for poor weather and night operations only). It was thought, however, that the addition of ARTS - like identification tags that did not clutter the display - would lead to the system finding some use during daylight operations and conceivably being used all the time.

Five of the airports have significant portions of their ramp/taxiway/runway networks blocked from view of the FAA tower. Of these, one is building a new tower and three have plans either to build a new tower or to modify the existing one.

2.3 GUIDANCE

Taxiing pilots depend on an airport's sign and marking systems to find their way around during daylight hours and on an airport's sign and lighting systems at night. The marking/sign/lighting systems constitute the airport guidance system. The airport interviews approached the guidance system from the viewpoint of in-

stallation and maintenance, which is the responsibility of airport management, and from the viewpoint of its effect operationally as seen from the control tower. The users, pilots, were not interviewed. If the general lack of complaints from pilots and the airlines to airport personnel concerning the guidance system is indicative, the system is generally adequate from their viewpoint. Table 2-3 summarizes those portions of the interviews pertaining to guidance.

Seven of the airports have centerline lighting, used primarily on arrival runways and on high speed turnoffs. With one exception, a large angled turnoff at Seattle-Tacoma, centerline lighting is considered operationally successful. Here, pilots tend not to see the centerline lighting and the turnoff until they have gone beyond the point at which a turn can be initiated safely. The beam aperture of the present units is too narrow for this situation. Maintenance is a problem. Water intrusion into the units leads to frequent and costly repairs. The extensive system of centerline lights at Seattle-Tacoma requires nightly maintenance. The care required in removing snow from around the units also extends plowing time.

Segmented lighting is an operational procedure by which only the edge and centerline lights associated with the active runways and the taxiways handling the traffic flow are lighted. The potential benefits of this procedure are the reduction of airport power consumption and of pilot confusion caused by the "sea of blue" taxi-lights. Two of the airports are using the procedure to some extent. Almost all of the airports, however, indicated that the switch panel at the ground controller station used to control the lights on the runways and taxiways is poorly organized and complex.

Seven of the airports have backlit signs. Opinions concerning these signs ranged from adequate to the signs being hard to read and difficult to place properly. The most urgent complaint concerning the sign system was that the blast from the engines of taxiing 747's has been putting signs out of commission on a regular basis. To date Los Angeles International has lost half its guidance signs and has replaced them with reinforced backlit signs. Logan has completed development of an unlighted, reflective sign which

TABLE 2.3. AIRPORT PROFILES/ GUIDANCE

	Chicago O'Hare	L.A. International	Boston Logan	Cleveland-Hopkins	Detroit Metro.	Greater Pittsburgh	Philadelphia Int.	Seattle-Tacoma	Bradley Int.
Centerline Lighting Location	Runway 14L & turn-off	Planned for 24L, 24R, 25L, 25R & certain high speed turnoffs	Partially in Runway 4R	Unidirectional units in Runway 5R	Runway 3L/21R	Bidir. units in both 10/28 runways & 10L high speed turnoffs	Planned for new and existing 9/27 runways	Bidir. units in 16R & associated taxiways to ramps	Unidirectional units in Runway 6
Operational Performance	Good			Good	Good			Beam too narrow-aircraft miss first turnoff from 34L	
Maintenance	Water seal problems; extends plowing time		Has too many problems	Water seal problems; snow removal damage	Increased maintenance relative to edge lights	Installation key to reducing maintenance problems		Nightly maintenance; working with manufacturer on fixes	Water seal problems; developed a cleaning machine
Segmented Lighting	No; switch panel too complex; all taxiways usually in use	No; switch panel adequate, but it is not done		Yes-on a limited scale; switch panel archaic	No; save power but could lead to mistakes	Would like to, but lighting panel not set up for it	No; not needed for present layout	No; switch panel poorly organized	Yes-on a limited scale; switch panel archaic
Sign System Type of Sign	Backlit	Backlit	Unlighted, reflective signs	Backlit	Backlit	Backlit	Backlit	None	Backlit
Operational Performance	Satisfactory	Adequate	Satisfactory	Sign placement difficult; signs hard to read	Adequate, except at intersection H/3R	Plan to redesignate taxiways	System not extensive enough	Routing "strange" aircraft difficult	Satisfactory
Maintenance	B-747 knock out signs; has a signing program	Half their signs lost to B-747; replaced by adequately reinforced signs	Satisfactory			747's seldom operate at airport but create problems each time	Costly		
Marking System		Reflective paint tried-tire scuffing quickly covered it with rubber			Adequate	Reflective paint tried-snow plows broke it off	Marking system inadequate	Reflective paint tried-got dirty & broke off in sections	Reflective paint tried-cost high & didn't last; developed a painting machine

can withstand 747 jet engine blast velocities, and with these it has replaced its backlit signs. O'Hare has a sign development program under way.

Four of the airports have experimented with reflective paint in an attempt to extend the usefulness of the marking system to night operations. The results have been disappointing. The paint was found to be expensive, got dirty, broke apart and scattered in large sections, and in general did not last.

2.4 NEEDS OF THE AGTC SYSTEM

During the course of the interviews, specific components of the AGTC system were specified as needing attention. These needs, indicated one or more times, were for:

1. a good, reliable electronic surveillance system, preferably with a Brite display and aircraft identification (this was the most frequently expressed need by FAA tower personnel);
2. a solution to the water seal problem with centerline lighting;
3. a smaller and better organized switch panel for taxiway/runway lighting;
4. a visual signal to be located at the threshold of arrival runways to cue pilots on their final approach as to whether or not they have mistakenly selected a closed runway;
5. a means by which a pilot on a taxiway with centerline lighting but no edge lighting can sense the edge of the taxiway;
6. more extensive light placement standards, such as the placement of edge lights with respect to soft shoulders;
7. standards covering a guidance sign that would satisfactorily withstand the effects of the jet exhaust of a taxiing 747;

8. an improved means for the removal of rubber buildup in runway touchdown zones (becomes very slippery when wet).

Beyond these needs, it was suggested at one airport that someone should be looking into systems of command and direction lights that would automatically lead aircraft through the taxiway network much like the STRACS system proposed for Kennedy International. It was argued that if such a system could reduce aircraft taxiing times by even a minute or two, then the system could be expected to pay for itself quickly, particularly at airports with high traffic levels.

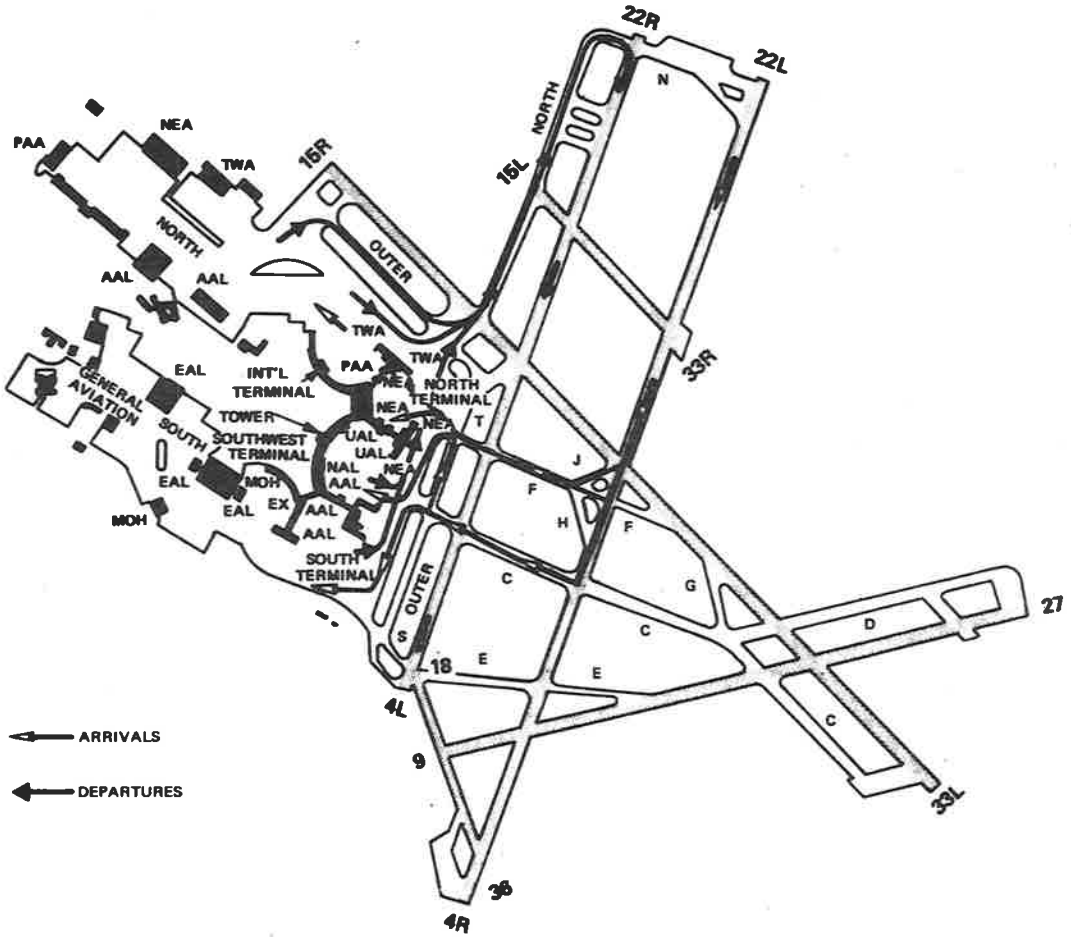


Figure 2-1. Boston Logan International Airport Map

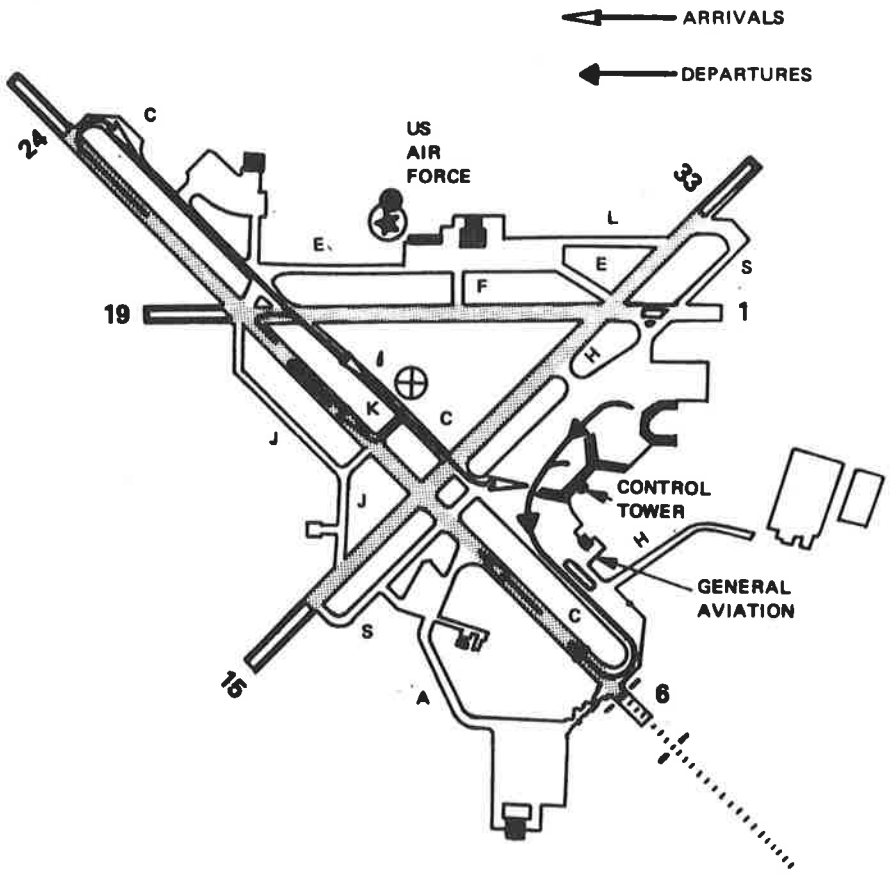


Figure 2-2. Bradley International Airport Map

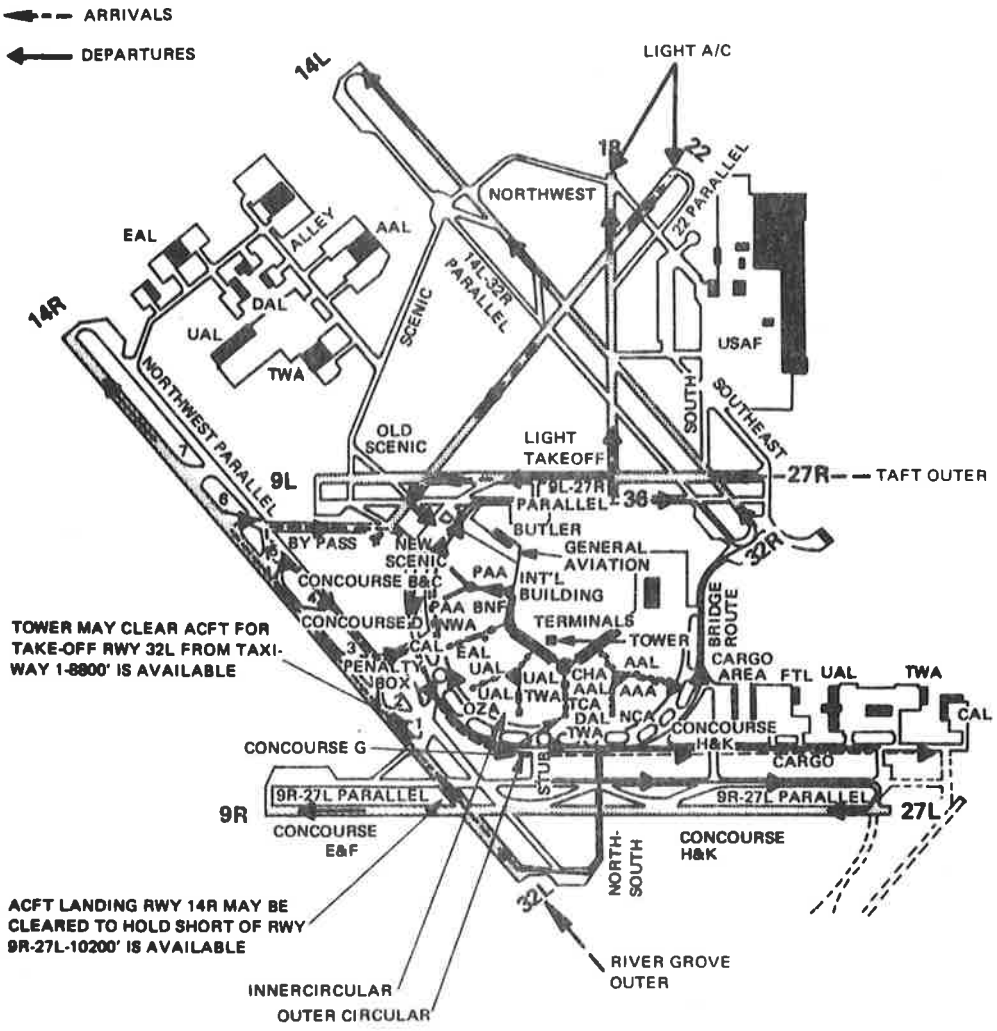


Figure 2-3. Chicago O'Hare International Airport Map

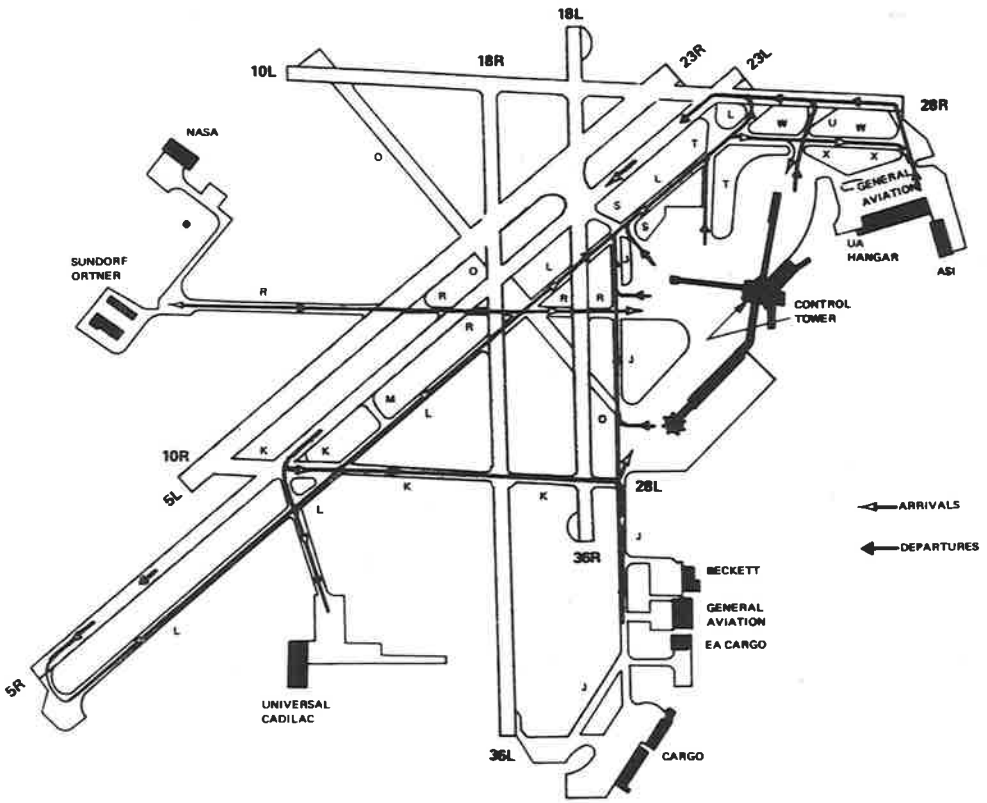


Figure 2-4. Cleveland-Hopkins International Airport Map

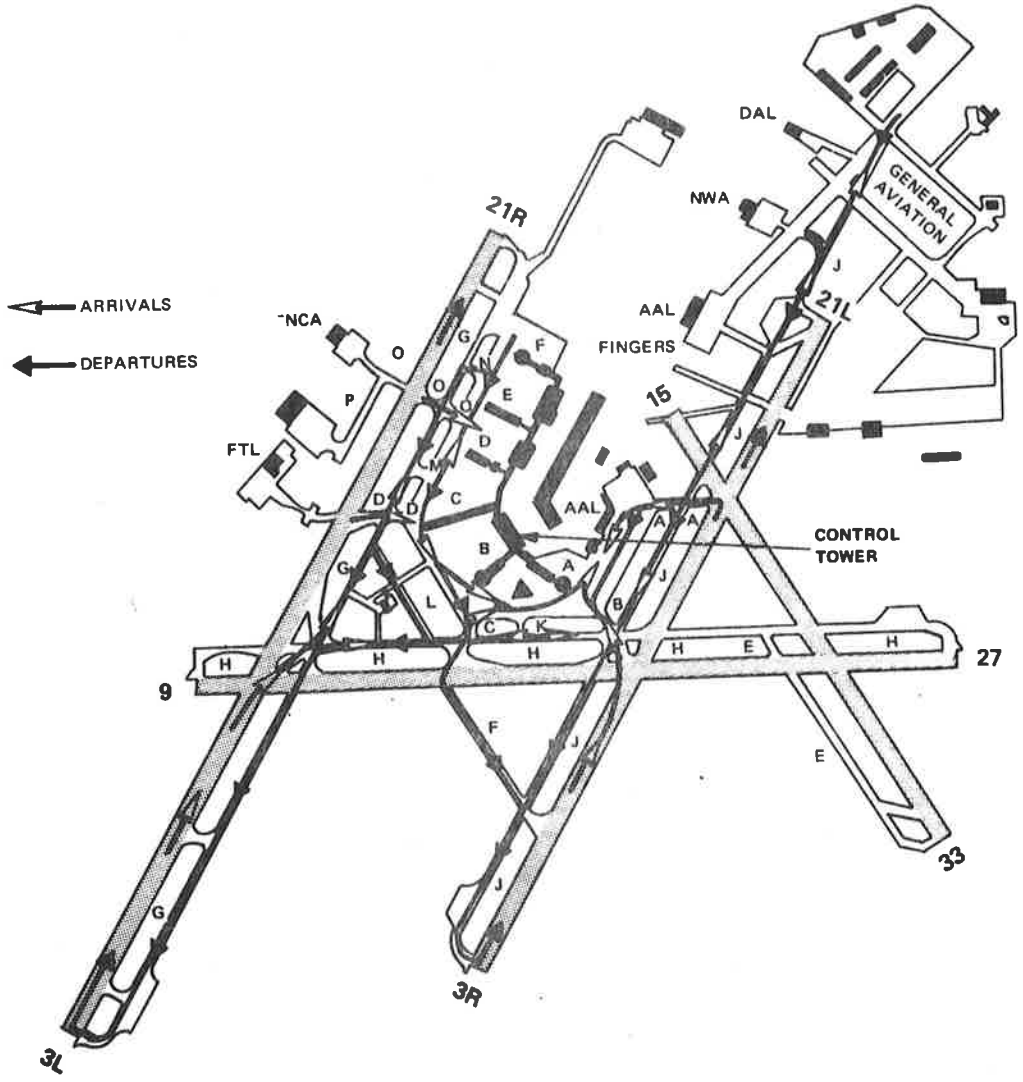


Figure 2-5. Detroit Metro. Wayne Co. Airport Map

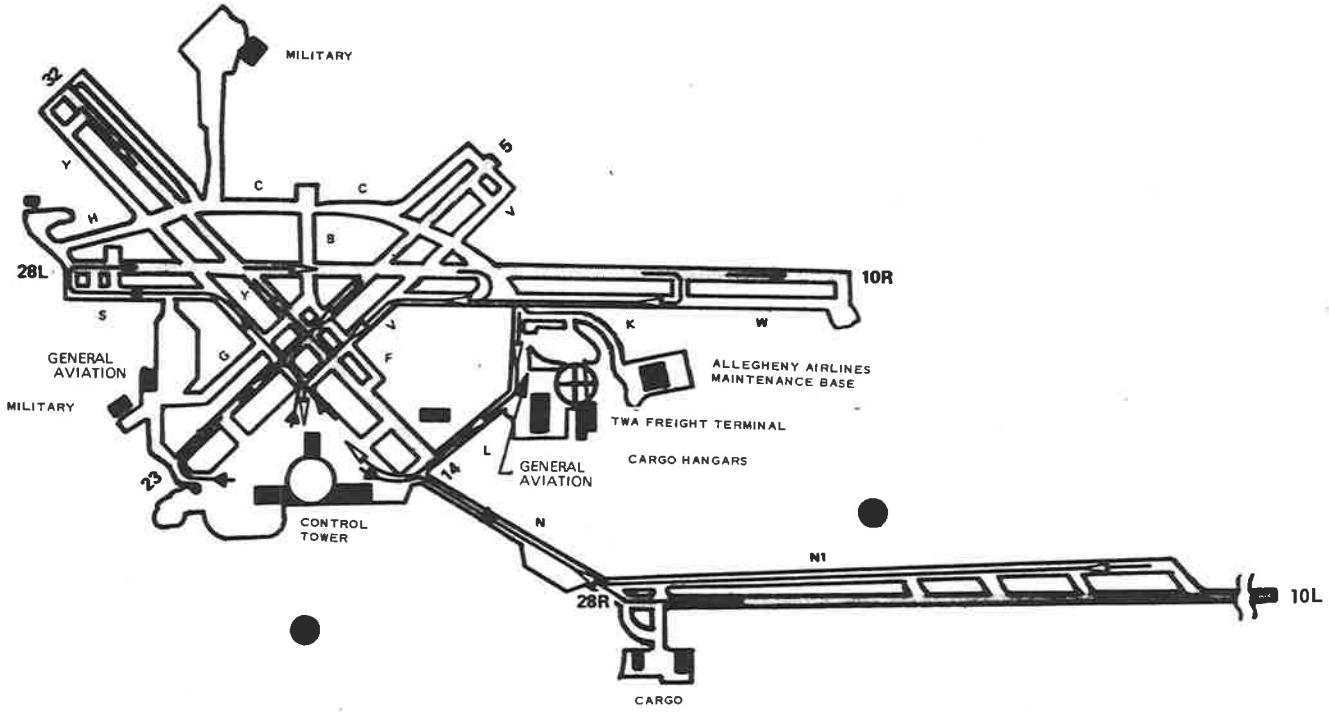


Figure 2-6. Greater Pittsburgh Airport Map

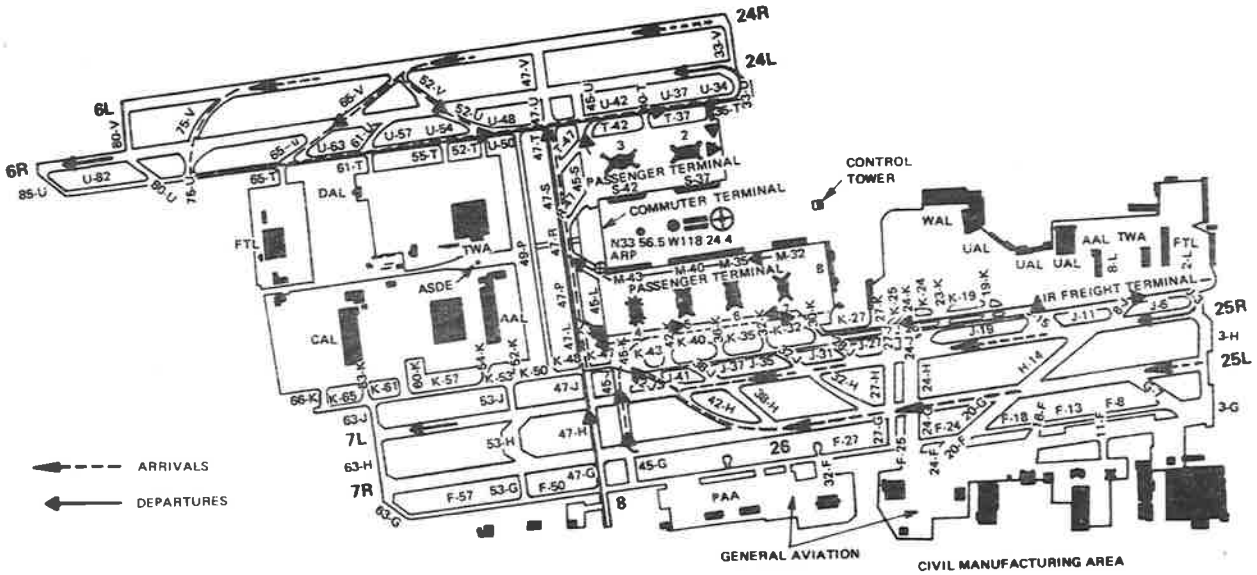


Figure 2-7. Los Angeles International Airport Map

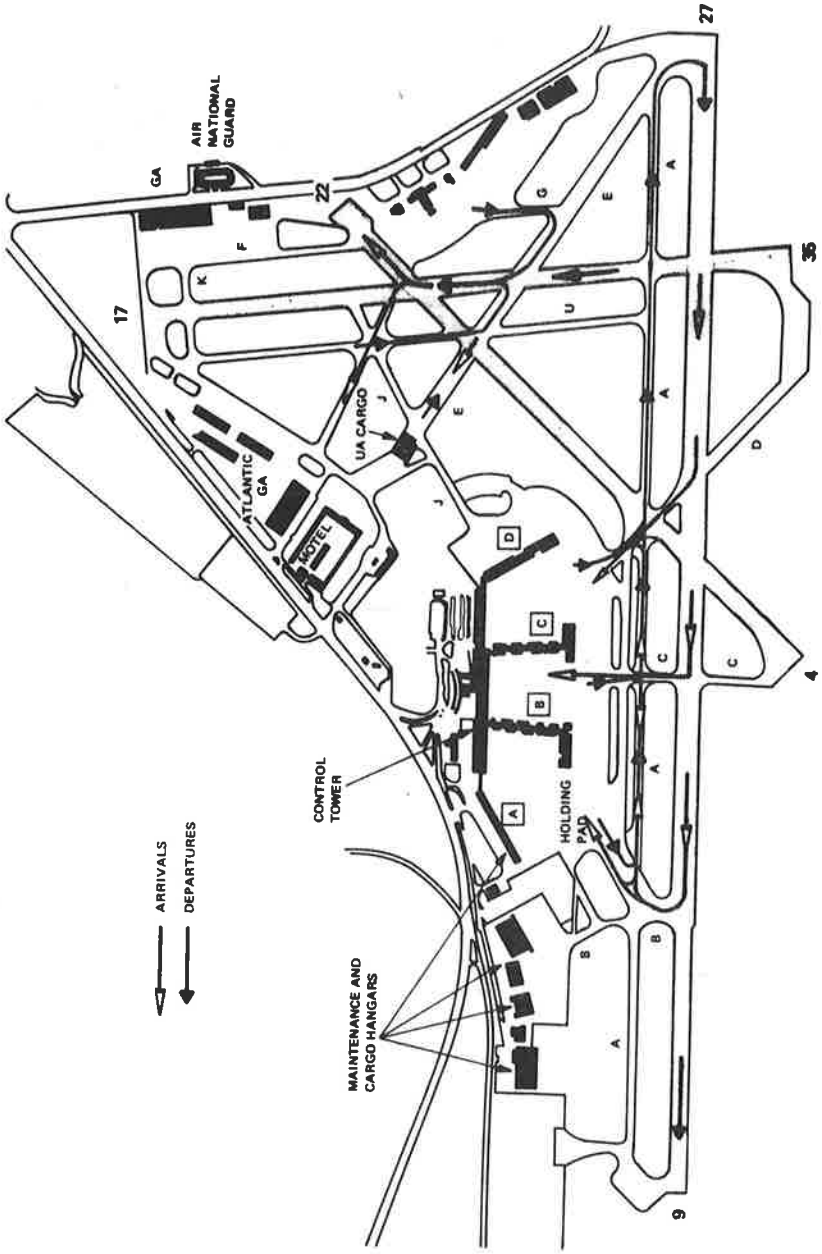


Figure 2-8. Philadelphia International Airport Map

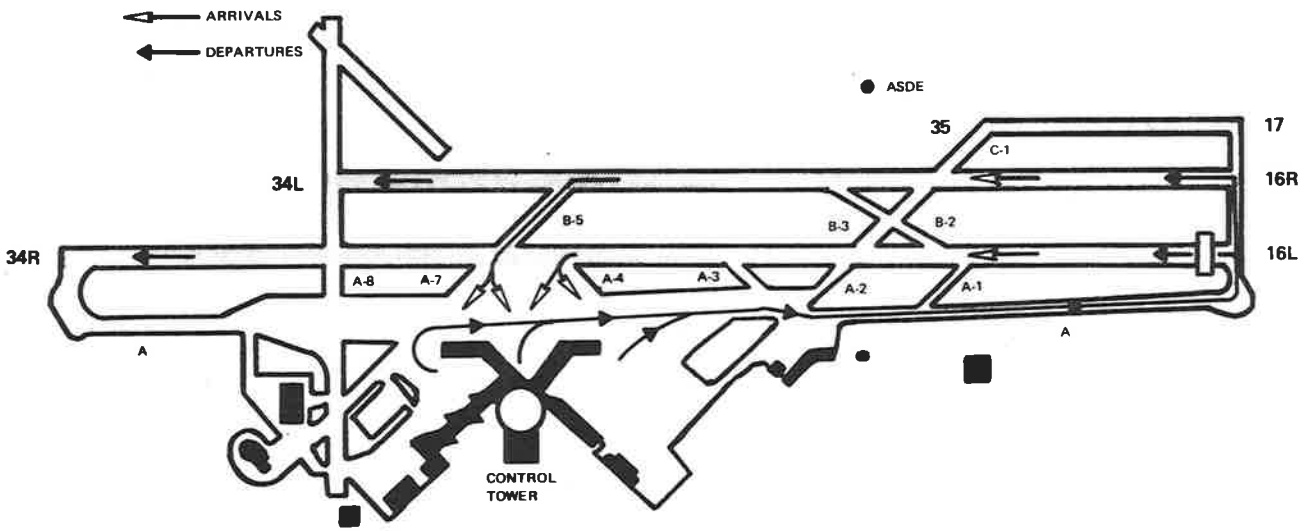


Figure 2-9. Seattle-Tacoma International Airport Map

APPENDIX A

AIRPORT INTERVIEW QUESTIONS

AIRPORT MANAGEMENT INTERVIEW

1. Concerning the current airport layout and in particular:
   a. The sign/marking/lighting system:
      - o How extensive a sign system is employed? Type (back lit or front lit)? Is it considered adequate by the airlines?
      - o How extensive a lighting system is employed? Type (edge or centerline, unidirectional or bidirectional)? Where is each located?
      - o What is experience with centerline lighting (snow removal, dirt in lens, water leakage)? How do they feel about taxiway centerline lighting with the half-inch slush limit consideration?
      - o What type of segmented lighting is employed? Is panel integrated at all? How is it broken up? Does tower use it to avoid power loss or confusion?
      - o How extensive a marking system is employed? Is ramp edge marked and enforced? Are the ramp vehicle roadways marked? How often do they repaint? Have they tried reflective paint?
   b. Snow Removal:
      - o What are the typical and maximum snow depths experienced by airport alongside the runways and taxiways?
      - o What is the effect of these snow depths on the lighting and sign systems?
   c. FAA Tower:
      - o Are there plans for a new tower?
      - o If so, for what reasons?

d. Gate location, identifiers and allocation by airline:

- o What is the current number of gates?
- o Are gates assigned to or leased to the airlines?
- o What is the airport's experience with floating gates?

e. Airline (ramp control) towers:

- o How many airline towers are there?
- o What is their function?
- o What is the desirability for supervision of controllable vehicles in the ramp area?
- o Would formal ramp supervision be desirable at this airport in the foreseeable future?
- o If so, who should be responsible for it?

2. Plans for airport expansion:

- o Are they in agreement with the FAA forecast?
- o Is the present airport configuration gate-limited or runway-limited?
- o What is the capacity limit of the current airport configuration?
- o Briefly, what do the airport expansion plans involve (new terminal facilities, taxiway/runway modifications, a new tower)?
- o Motivation for these changes?
- o What environmental/political pressures are they experiencing concerning their expansion plans?
- o How do they calculate future gate requirements? Criteria used?
- o How many gates will be added? How will they be allocated?
- o What is the ultimate upper limit on the airport?

3. Plans for reducing minima and anticipated implementation dates:
   - o What are the current landing and takeoff minima?
   - o When is CAT II planned and where?
   - o When is CAT III planned and where?
4. Plans for ATC changes:
   - o What is the schedule for TCA?
   - o What is the schedule for ARTS?
   - o Where is the IFR room located?
   - o Where is the ASR radar located?
5. Are there any R&D efforts that we might be interested in?
6. Do they have any suggested areas, either procedural or with equipment, that they would like to see this program address?
7. Organization chart.

FAA TOWER INTERVIEW

1. Does the ground or local controller have any acute problems with:
   a. Staging:
      - o Is airport gate-limited?
      - o If it is, how often must an aircraft be held to wait for a gate?
      - o Where does the inbound staging take place (in air, in taxiways, in ramps, in formal staging areas)?
      - o Is outbound staging a problem?
      - o Does flow control cause a problem for the ground controller?
      - o What is length of the typical peak departure queue?
      - o Where does outbound staging take place (some done at gates)?

b. Intersection Control:

- o Does the controller have a problem controlling any particular intersection or taxiway link?
- o If so, identify the area?
- o Would they be receptive to local autonomous control?

c. Surveillance:

- o Where are the blind spots?
- o Are there any critical blind spots?
- o What is the controller's role in these blind spots?
- o Do night operations differ from day operations due to lost surveillance?
- o What is the percent increase in controller workload at night?
- o What are the takeoff minima?
- o How does the controller handle ground traffic at reduced visibilities (one aircraft at a time)?

d. Sign/Marking/Lighting Systems:

- o How adequate is the sign/marking/lighting systems?
- o What is their experience with edge and in pavement lights?
- o Would they favor a segmented lighting system?

e. Ramp Supervision:

- o What is the desirability for supervision of controllable vehicles in the ramp area?
- o Is ramp supervision presently done to some extent? Explain?
- o Would more formal ramp supervision be desirable at this airport in the foreseeable future? Explain?
- o If so, who should be responsible for it?

2. Manning of the Local and Ground Controller stations:

a. How many local and ground controller positions are used?
b. If they plan to add a second position, why and when?
c. Is a VHF frequency available?

d. If the second position already is manned,

- o When was it done?
- o Why was it done (VHF channel, surveillance)?
- o How long will this be satisfactory (either a date or a capacity estimate and reason for final breakdown)?
- o What is envisioned as the next step after dual manning?

3. Airport Growth:

a. Do they agree with the FAA forecast?
b. What is the practical expansion limit of the airport?
c. What will be the final limiting factor (gates, runways)?

4. ASDE Radar:

a. If they have experience with ASDE,

- o How often do they use it?
- o What percent of the time is it used and by whom (local or ground controller)?
- o Is it used for night operations as well as for bad weather?
- o What is the availability of the ASDE?
- o How much maintenance is required? What sort?
- o Would they use a reliable Brite display any differently?
- o Would they use a bright display with ID any differently?

b. If they do not have experience with ASDE,

- o Why don't they have one? Was one ever considered or requested?
- o Would a good, reliable ASDE Brite display be of any immediate or near term use?
- o How would they use ASDE with ID?

5. Are there any R&D efforts that we might be interested in?

6. Do they have any suggested areas (procedural, equipment) that they would like to see this program address?

APPENDIX B

AIRPORT INTERVIEW NOTES

LOGAN INTERNATIONAL AIRPORT (12 NOVEMBER 1971)

AIRPORT MANAGEMENT INTERVIEW

The Airport Layout Plan for Expansion

1. Extend the inner and outer taxiways around the terminal area to the Eastern Airlines Terminal.
2. Extend the outer to service extended 4L, 9 and new 15 STOL/GA.
3. Build new 15L 1200' from 15R
4. As of now, the North Terminal has two ramp towers used by the airlines. Eastern has no tower but exercises control. The new International Terminal will have a ramp tower.
5. The extension of 27R is meeting stiff resistance.
6. Choice for a CAT II/CAT III runway
   a. First choice is the proposed 15L runway. The creation of this runway is meeting stiff opposition from the community and the local and state governments.
   b. An alternative is the present 15R runway although there are disadvantages.
   c. Another alternative is the present 4R runway. CAT II operations would require a reliable system for determining when the approach airspace associated with 4R has been violated by the mast of a ship in the channel. CAT III operations would require the ability to control ship traffic off 4R.
7. Currently, there are 64 gates.
8. Ultimate gate capacity of airport is between 85 and 94 gates, depending on aircraft mix.
9. The proposed International Terminal will have shared gates.
10. As of now, the North Terminal has two ramp towers. The Eastern Terminal has no tower but exercises ramp control.

11. The proposed International Terminal will have a ramp tower.

12. The proposed South Terminal may be reduced somewhat in size.

Blind Spots

1. Currently, Logan has one blind spot behind the Eastern Terminal. Another blind spot exists behind the TWA Terminal; however, one can see the tops of the commercial jets in that one.

2. The FAA has disclaimed responsibility for traffic in these blind spots.

3. There was general enthusiasm about the possibility that an autonomous controller could cover the present blind spot behind the Eastern Terminal and the future blind spot behind the proposed South Terminal. These blind spots are going to cause a difficult traffic control situation. An autonomous local controller system may be the answer. The best alternative to date is a "follow me" ground vehicle to shuttle the aircraft back and forth over the link.

Ownership of Terminal Facilities

1. The Port Authority owns the terminal facilities and rents them to the airlines.

Ramp Control

1. Agree with the O'Hare Airline Study concerning the need for ramp control, but premature for Logan at this time.

2. International will have ramp control to be supplied by Port Authority.

Taxiway/Runway Lighting

1. Segmented control of the taxiway edge lights in order to mark those taxiways that are normally in use for the particular active runway configuration. This should provide orientation and routing assistance to taxiing aircraft.

2. Use of centerline reflectors to assist pilots in making the runway turnoff. The Juliet turnoff on 4R was given as an example of a turnoff frequently missed or mishandled by landing aircraft.

3. The proposed extension of the inner and outer taxiways will be edge-lighted.

4. New inner and outer will be edge lighted. Still too many problems with centerline lighting. Currently have centerline lighting only on first portion of runway 4R.

5. Centerline lighting may be used in the two-ramp lanes in the proposed Cargo Terminal due to the limited clearance between the wing tips and the flanking cargo buildings.

Sign Program

1. The airport has completed developing an unlighted, reflective guidance sign structured to withstand 747 jet blast velocities (see Gainer's report - Item 1.13)[5].

2. The signs have been successful from a pilot and maintenance point of view and have replaced the airport's back lit signs.

FAA TOWER INTERVIEW

Staging

1. There are no formal staging areas for inbound aircraft. They are held in the air upon pilot request or in the taxiway system at some convenient location. No formal staging areas are in the expansion plans for Logan, either.

2. The primary need for outbound staging other than for the departure queue is for aircraft being held due to congestion problems at their destination airports. Less frequently, staging is required for aircraft that receive "late" clearances. The primary reason for this lateness is due to filing the flight plans late.

Routing

1. Construction does have impact on routing. Tower has control over construction vehicles. Radio cars, flagmen (?), are required of contractor. Tower participates in pre-construction conference with bidders to set ground rules for construction.

Weather

1. Fog is greatest problem. Snow some. Rain seldom.
2. Loss of surveillance is compensated for by VHF and strips.
3. The lowest takeoff minima for revenue flights at Logan is 1/4 mile for 4-engine aircraft.
4. A/C are permitted to roll whenever they request it, regardless of weather.
5. Ops at or below takeoff minima occur three percent of the time (a guess).
6. In severe conditions, the ground controller tends to roll only one aircraft at a time in any particular area of the airport.

ASDE Radar

1. When they had ASDE, they used it primarily in extreme weather (i.e., three percent of time at most). The full use of ASDE at night was inhibited by a lack of associated and continuing identification of departing queues.
2. It was shared about equally between ground and local control.
3. Concerning ID for the ground controller display, it was thought that the question was not one of desirability but one of ID format. If ASDE could be provided with ID, it would be useful in transferring traffic during active runway shifts. Night operations are much different than day. Controller must use lights and shadows against edge lights, etc. Designations cannot be seen. Radio and flight strips must be used much, as in poor weather. Workload increases 25 percent (a guess) over day operations. Fortunately the pace of aircraft operations decreases at night.

Ramp Assistance

1. Pushback clearance is for safety in that it alerts other controlled vehicles in the vicinity that a particular aircraft is about to push back. However, the ground controller has no jurisdiction over the ramps.

2. Ramp management - The ground controller assists aircraft on the ramps but does not control them. Control responsibility ends at the outer edge of the circumferential terminal truck lane.

3. Ramps should be supervised someday.

4. Airline towers are used for operations offices and gate control. Airline radio communications to aircraft originate there. Not all airlines have VHF frequency.

5. At Logan, an FAA bulletin disclaims responsibility for control in ramp area, but requests aircraft to notify the ground controller of pushback. It then advises the aircraft as to clearance if possible. This is also used as a cue to entry into the ground system. Pushback can take five to nine minutes before engines are up and taxi instructions are requested.

Manning

1. Saturation due to capacity has required Logan to request a second ground controller for next year. The voice communication channel is saturated so that the ground controller cannot communicate with the ground traffic in a timely fashion, and the pilots must wait an unacceptable period of time (a minute or two) to initiate communications with the ground controller. A major block to getting the second ground controller exists in that there is no available frequency for his use at this time.

2. There is a coordinator (i.e., assistant local controller) between the tower and approach controller. Separation of incoming aircraft is negotiated if required to permit ground movement across actives or for departures. When traffic is high an attempt is made to balance delays between arriving and departing aircraft.

3. Responsibility for the taxiway system is split between the ground controller and the local controller -- the local controller controls all inbound aircraft until each aircraft has crossed the last active runway.

Blind Spots

1. The proposed South Terminal (to be started in two years) will create a large blind spot. The significance of the blind spot to the ground controller in handling traffic around the South Terminal depends on the ability of the Port Authority to construct the proposed extension of the inner/outer taxiways around the South Terminal. Since this taxiway construction requires some filling of the Bay, it is meeting stiff resistance and may not be completed in a timely fashion. If the taxiway construction is not completed before construction of the South Terminal begins, the ground controller will have to handle traffic through a long, narrow blind spot that will permit one way traffic only and has the potential for a nose-to-nose condition.

Critical Intersections

1. The controller has responsibility for all intersections but generally gives complete routings assuming intersection clearances. Crossing of active runways is, of course, most critical.
2. The runway/taxiway intersection called out was Sierra/4L.
3. Paralex is a problem in the area of the Charlie and runway 9 intersection (asked a leading question).

General

1. 342,000 annual operations is the limit estimated by the FAA. This capacity limit is based solely on present runway/taxiway availability and its impact on unacceptable delay.
2. This capacity limit is with respect to runways and probably does not take into consideration either gate or AGTC system capacity.

3. The G.A. pilots operating at Logan are experienced and, except on occasions, cause no unique problems.

4. Logan Tower could use some help in developing a reliable system to determine when the approach airspace off 4R has been violated by a ship's mast.

5. A visibility chart shows prominent features visible from the Tower; the ground controller uses it to gage the visibility from the Tower.

6. Departing pilots want a firmly structured departure sequence in order to predict when they will be rolling. For this reason pilots tend to line up in a departure queue when visibility is below the airport minimum for takeoffs.

BRADLEY INTERNATIONAL AIRPORT (15 DECEMBER 1971)

AIRPORT MANAGEMENT INTERVIEW

Signing/Marking System

1. Airport has an extensive sign system (back lit variety). Have found it to be very satisfactory.
2. The signs are up in preparation for CAT II operations on 6.
3. Reflective paint was tried five to six years ago, but the paint did not last. The cost was high. Reflective glass beads were tested on a runway. The beads were gone within four months.
4. Concerning markings, the airport must be done twice a year.
5. A contractor charged $10K for just striping the three airport runways. The airport has, therefore, developed its own machine to do the job and can do the entire airport in one day.

Lighting

1. Presently have Westinghouse one-directional centerline lighting on 6. Have water seal problem with the units. Forty are to be replaced, but as additional units fail, they will not be replaced. The airport hopes to replace all these units with new bi-directional units next fall.
2. Snow plow blade is a convertible steel/rubber type. It is very satisfactory. Only one centerline lighting has been lost in using a steel blade. With the unidirectional lights, they plow from the rear. The lens is, therefore, not affected. Bi-directional may be a different story. They do not have icing difficulties. However, brooming is the answer to snow removal for centerline lighting. Management hopes to get a brooming apparatus.
3. Some company is trying to develop a broom system for the front of its snow blower. Brooms are used only down the centerline. Conventional equipment is used on either side. Removing snow from edge lighting should never be a problem -- it is all in

plowing technique. Plows scoop snow away from edge lights, and then blowers blow it up over the edge lights.

4. Centerline lighting cleaning done twice a year. A very satisfactory sand blasting technique using walnut shells has been developed that requires only four hours to clean 370 centerline lighting units.

5. Segmented lighting presently done to some degree. Tower switch panel is adequate for segmented control. Bradley is nearing its power consumption quota. Expansion will induce use of segmented lights. They may have to deal with three power companies instead of one as they move into their territories.

6. Winter maintenance cost of centerline lighting to runway edge lighting is hard to estimate.

Critical Intersections

1. Sugar and Charlie is the airport's busiest intersection. Conveniently, it is located near the tower for easy observation.

Blind Spots

Blind spots, small and insignificant, include:

1. ramp near gate 10
2. ramp at International Terminal
3. taxiway J
4. the old National Guard Ramps

Tower

It is satisfactorily located.

Gates

1. Thirteen at this time; airlines double gate

2. The Authority can control gate usage

Airline towers

None - no need for ramp management.

ASDE

1. Never have had one and see no need for one in the future due to capacity. Even under low minima, pilot feedback on runway clearance appears adequate at Bradley.

2. Today airport operates when the ground controller cannot see the entire airport, and he satisfactorily handles the traffic.

Recent Drop Off of Annual Operations

1. Due primarily to a reduction of general aviation operations.

2. Airline operations are dropping off somewhat due to use of stretch aircraft; however, the annual number of passengers being handled is increasing.

Airport Facilities

1. PANCAP is 270 to 280,000 (it was thought), and saturation of the runways should not occur for six to ten years.

2. The gates will be saturated before the annual operations increase another 30%. A study to recommend a course of action has been completed, and it suggests that the number of gates be increased to 24 in the short term with a provision for later expansion to 50 gates. The study itself has not been accepted as yet and at present serves as a guideline.

3. The governor has suggested that Bradley seek to become the fourth New York jetport.

4. To acquire adjacent lands the airport must request it from the three surrounding towns, and if denied must prove its need for that land in the courts.

Runway Expansion

Presently talking of putting in a parallel 6 to the west of the existing one. This is of low priority, however. Gates are the major concern.

CAT II Runway

6 is being certified, a 5-year process to date. Primary equipment is okay. The system monitor is holding up certification.

General

1. ARTS goes into operation 5/72.
2. IFR Room and ASR on site.
3. Bradley is on call to handle international flights to help JFK when needed. They have handled 35,000 passengers through Customs since March of 1970. Airport is near its power limits.
4. No problem at Bradley with controlling ground traffic. Service traffic in ramps is restricted to marked traffic lanes and observes a 10 mph speed limit. Control of this traffic is 90% effective.

FAA TOWER INTERVIEW

Sign/Marking System

1. No complaints heard yet.
2. Sugar and Charlie is a critical intersection.

Segmented Lighting

Segmented lighting exists to some degree. The switch panel is archaic and streamlining to a small switch panel with minimum controls is desired. Checklist-type combinations would be quite acceptable, where for particular actives a set of switches are operated. Integrated and small is the key.

Ramp Control

1. Airport is awaiting certification as a Gateway Airport. When that happens, 19 airlines want to operate at Bradley. This will create a gate and a ramp problem for the airport.
2. Concerning ramp supervision, the airlines do it now.
3. Gate-scheduling preferential gates at the present time.

Manning

Airport has one ground controller, one local controller and an assistant local controller.

ASDE (Based on experience at the three N.Y.C. airports)

1. ASDE availability is good, since it is closed down on good visibility days. It is used nights to help the controllers cope with the "sea of blue". The ground controller uses it more than the local controller. With ID, the display would probably be used during the day.
2. At JFK, the ASDE prevented an accident when the ground controller noted that a taxiing aircraft had become confused and had turned onto the active departure runway and stopped on it during low visibility operations.
3. A highly reliable (solid state), Brite ASDE would greatly benefit ground controllers. Safety is of great concern here. At night and in bad weather aircraft blunder onto actives too often.

General

1. Night Operations are no problem. The workload increases, but cannot estimate exact amount.
2. Takeoff minima 1600 ft. RVR.
3. Low visibility operations: use a gate hold scheme and tend to roll only one aircraft at a time.
4. Ground controller must cope with an inbalance of arrivals and departures as much as ten times a day.

CHICAGO-O'HARE INTERNATIONAL (13 JANUARY 1972)

AIRPORT MANAGEMENT INTERVIEW

Sign System

1. Have the backlit type. The airport had adequate signs before the 747. One intersection requires four signs a week at $900/sign.
2. The airport has been working to develop a 747-proof sign. They are testing a new type of backlit sign on the field that seems to be able to take the 747 exhaust blast.
3. Concerning signs, first priority must be given to developing a 747-proof sign that meets the FAA standards. Beyond this, something more (not specified) is needed.

Lighting System

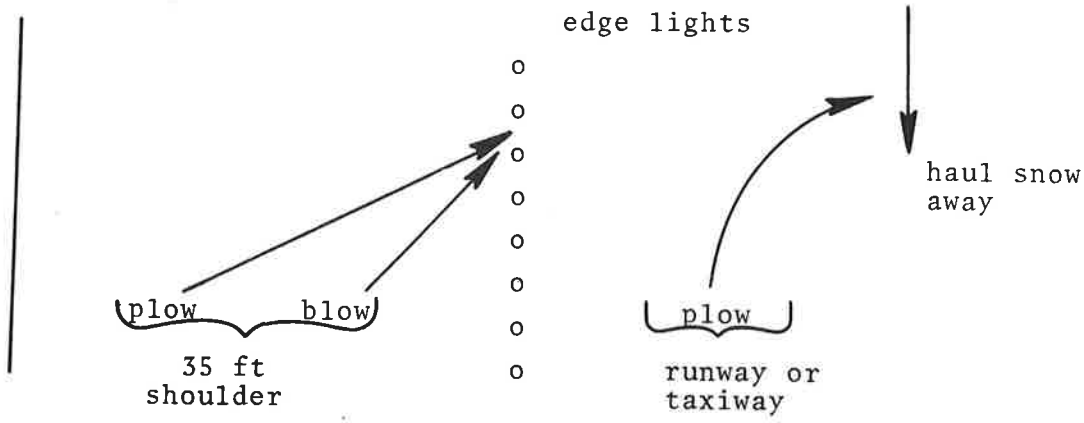
1. Centerline lighting (CL) is in on 14L and its turnoff. It is good operationally but extends plowing that runway by two hours.
2. Airport uses rubber blades and brushes for plowing.
3. CL has a high maintenance cost, in part due to water getting into the units.
4. The CL units should be installed below grade.
5. The airport uses an amber edge light to denote intersections of the service road and taxiway. This has eliminated the previous problem of service vehicles missing the proper turnoff and ending up in the mud. It has been suggested that this scheme might be tried to denote runway turnoffs.
6. Concerning segmented lighting, the airport lights up the entire field unless a runway or taxiway is closed.

Marking System

1. All markings are repainted twice a year for $320K and when needed in between.
2. There is a traffic lane and a centerline concourse line to guide aircraft in the ramps.
3. There is no lane for service vehicles in the ramps. Such a traffic lane would foul things up.

Snow Removal

1. The airport does not allow snow to build up.
2. Plow technique



Gates

1. There are about 60 gates at present.
2. Only seven or eight gates are not leased.
3. The various international air carriers take turns at scheduling the international gates by the month.

Ramp Supervision

1. American Airlines has an airline tower and United Airlines is putting one in.
2. Concerning pushback clearance, the controllers do not have time to handle them ordinarily. The exception is the seven to ten widebodies that are in and out of the gates between 3 and 8 pm.

Pushbacks for these aircraft are handled by the controllers.

3. Maintaining flow between the concourses is the key to keeping the ramp areas from getting snarled.

Expansion Plans

1. The airport is just about at capacity for its present configuration.
2. The airport presently has 11,000 lineal feet of terminal frontage and has plans to expand to 20,000 lineal feet.
3. One of the possible terminal expansion schemes involves converting the present concourse fingers into satellites and to having all the satellites connected by an underground people mover.
4. The expansion plans for the runway/taxiway system include pushing the ramps, the inner taxiway, and the outer taxiway out from the present terminal to make way for terminal expansion.

General

1. A guidance system was proposed by a company at a recent AOIC meeting. Such a system could be useful in preventing aircraft from getting lost in the taxiway system. (This may have been the LFE "STRACS" design for JFK.) This is the type of system that the R and D types should be looking into. Although such a guidance system might cost a few million dollars it would pay for itself in a short time, if it could reduce the average aircraft trip time through the taxiway system.
2. The taxiway that crosses the bridge is not stressed for 747's (loaded).
3. The airport can be operated as two separate operations which is very useful in snow removal. One set of runways is closed for snow removal while the other set is active and then operations are switched, as needed, to complete the removal of the snow.

4. The airport consists of 7500 acres and is landlocked.

5. Rubber removal from the runways is a problem because it costs the airport in both capacity and utilization.

6. Fillets are needed at a number of intersections (for the 747's?)

7. The airport has found that wires inbedded in pavement should be placed in pipe. If they are not, the wires tend to pop out and lie on the surface of the pavement - even when they have been seated in their slots with epoxy.

8. The airport only has one small blind spot.

9. There are 26 miles of service road at the airport (Given the driving rules for service vehicles) felt a possible use for local autonomous controllers to control service road traffic at intersections within the taxiway system.

10. To save controller VHF channel utilization, all Commission vehicles are on another frequency and there is a second frequency for general useage. The controller can monitor these frequencies.

11. The Commission has 650 pe ple and the airport is manned by 19,000 people.

12. Midway airport has been opened to commercial operations.

13. Utilization and capacity of the airport are the day-to-day tests against which all proposed actions are measured. To operate the airport at its present levels requires close cooperation between the airport, airlines, and FAA tower personnel and a realistic division of labor between the three groups. For instance, the air carriers are responsible for the proper utilization of their own gates because no one else has the time to do the job; and if there is a gate foul-up, the responsible air carrier will be the one that suffers.

14. Only seven or eight gates are not leased.

15. ATIS is loaded and some sort of gate information system is needed.

16. A surveillance display with ID would be ideal

FAA TOWER INTERVIEW

Staging

1. The sequence for inbound staging is:
   a. There is always at least one aircraft in the penalty box. Aircraft hold there for up to one hour. The box can hold four or five (707) sized aircraft.
   b. The airport can hold up to 60 aircraft in the taxiway/ramp system.
   c. When still more aircraft must be held, the additional ones taxi around the terminal.
   d. When the airport surface can hold no more aircraft, the remainder are held in the air or directed to some other airport.
2. Outbound staging is a real problem when flow restrictions on New York City bound traffic are in effect. The problem was reduced to some extent when the flow control center in Washington D.C. became operational. A typical peak departure queue is five to six aircraft on each of the two departure runways. This is equivalent to a 15 minute delay per aircraft. The maximum queue, not due to weather, is around 20 aircraft per runway.

Intersection Control

1. Two intersections where the scenic and the old scenic taxiways cross runway 9L are heavily used.
2. The taxiways taking traffic between the ramps and the present Outer taxiway are heavily used.
3. One problem with an autonomous local controller may be the education of the pilots in the use of the control lights and then the enforcement necessary to make sure that the pilots obey the lights.

Surveillance

1. One small blind spot to the tower exists. However, it won't hide a 707.
2. Night operations require the controller to depend more on his strips. Workload increases by 25% due to the difficulty of keeping track of aircraft marked by lights against an airport surface etched in lights.

Sign System

1. They have heard of no complaints; all the pilots know their way around the airport. It is rare for anyone to get lost in the taxiway system.

Lighting System

1. The CAB has a taxiway/runway lighting panel that will permit segmented lighting. However, the panel is too complex and all taxiways are generally in use, so all taxiway lights are left on. Lighting on inactive runways is turned off.

Ramp Supervision

1. Pushback clearance is only required of the 747's.
2. AA and UA conduct ramp control for their own aircraft.
3. Concerning floating gates, they described the Willow Run Experiment in which the airlines got together and took turns gate scheduling. The scheme worked well until the gate allocations became biased; the experiment has been terminated.

Manning

1. Manning

	ground controller position	local controller position
1965	1	1 plus a standby
1966	1	2
1968	2	2

2. O'Hare went to two ground controllers due to both VHF channel saturation and traffic congestion.

3. Two ground controllers should remain sufficient with increasing capacity; something else will go first. If this is not the case and the two ground controller system saturates, a third controller may be introduced to handle the GA facility which will be relatively isolated from the rest of the airport ground traffic.

4. Concerning the traffic split between the two ground controllers, the inbound/outbound split has been found the easiest to use.

Airport Growth

1. O'Hare has been, is, and will remain gate limited.

ASDE

1. ASDE availability is good.

2. Performance has been the big problem with ASDE particularly in precipitation.

3. The local controller is the primary ASDE user. The ground controller seldom needs to use it for the airport rarely operates in CAT II weather. In CAT I, the ground controller can see the traffic and under CAT III there is no need to move any traffic.

4. ADSE is not used at night. It is only used when the ends of the runways disappear in the weather.

5. A good ASDE Brite display, with or without ID, would be primarily used at night and in low visibility. On a clear day, it is much faster, cleaner, and easier for a controller to judge an aircraft's movements by visual observation than on an ASDE (e.g., in estimating when an aircraft will turn off a runway).

Suggestions

1. Concerning our request for them to suggest additional areas that they would like to see the program address, their reaction was that O'Hare's primary need is for more concrete.

Observations on O'Hare ASDE Brite Display Seen in the CAB 1/13/72

1. The grass areas on the airport surface were partially covered with snow. The snow resulted in a loss of background on the ASDE display, a loss in definition of the edge of the runways and taxiways.

2. Loss of detail around the ASDE antenna position due to either a problem with the duplexer or the height of the antenna above the ground.

3. Aircraft targets tended to be bulb-like, but aircraft size could be distinguished between the DC9-707-747 sized aircraft. General aviation aircraft and ground vehicles were difficult to recognize except by movement.

General

1. AIL has a faster than real time movie of O'Hare traffic as seen on the ASDE over a 24 hour period.

2. Heaviest traffic during the day is from 5:00 pm to 7:00 pm.

3. Aircraft departure time is kept in a log in the IFR room, and arrivals in a log in the CAB (arrival time not logged for each aircraft).

4. Airport is well laid out and the traffic is well disciplined.

5. Motto of the tower is "save-time".

6.

Runway acceptance rate	Separation
45 AC/hr	3 miles
30	4
24	5

7. Controller (airside) manually handles seven aircrafts; with ARTS, controller handles up to 15 aircraft.

8. Pushback procedure

   a. The pilot calls clearance delivery for taxi, is told to monitor ground control, and then the strip is handed to ground control who then calls the aircraft.

b. The pilot waits for the call from ground control for two minutes. After that time he is to contact ground control to request instructions.

9. Departure queue procedure used at O'Hare

a. Ground control releases the aircraft when it enters the departure queue.

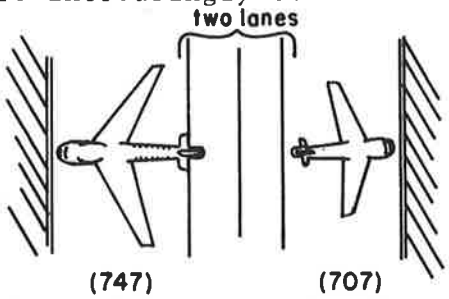
b. The pilot does not contact local control until he is next to take off.

10. O'Hare has a reservation capacity of 135 AC/hr (115 air carrier, ten air taxi and 10 other).

11. O'Hare has seven ILS runways and two more are planned.

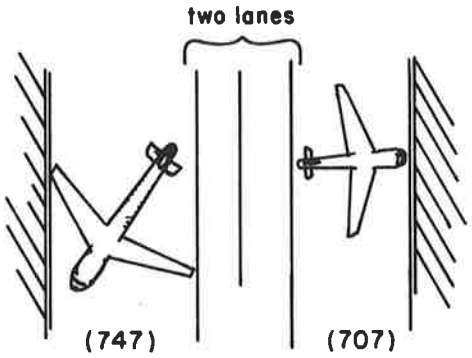
12. The ASR4 and ASR7 are combined in a dual antenna system.

13. The airlines have put their wide body jets at gates along the side of the concourse fingers instead of at the ends. The result is that the two lanes for traffic between the concourses are increasingly restricted to one lane.



restricted to one lane

The following solution would cut gate utilization by 30% and is therefore not acceptable



CLEVELAND-HOPKINS INTERNATIONAL AIRPORT (14 DECEMBER 1971)

AIRPORT MANAGEMENT INTERVIEW

Lighting/Sign/Marking System

1. Pilots occasionally complain of sign inadequacy. The placing is poor.
2. The back lighted signs are hard to read. Aware of PONYA studies.
3. Cleveland has an ADAP request in for additional signs and better placement of the ones already in.
4. 5R has centerline lighting. Edge lighting is elsewhere.
5. The CL lights are old L832 and are susceptible to snow removal damage. Rubber blades will be tried this year.
6. It is felt that centerline lighting is good operationally but not needed since they are below CAT I so infrequently.
7. Segmented lights are a good concept but would be quite expensive if the airport already had others in. The Commission E E has examined the concept to some extent.
8. Backlit signs are awkward to read, and lack contrast in daylight or at night.
9. Cleveland has been a bad airport for sign placement. If a new scheme could be worked out there, it should work anywhere.
10. Segmented lighting is an excellent concept.
11. With expansion plans a new tower has been contemplated but no request has been made. Blind spots are currently not a problem.
12. Centerline lights are impractical. "Certainly not to be used on taxiways". They are operationally good but are having trouble with water intrusion, and snow removal. It is felt that rubber blades are not the answer, that blade corners or shoe wheels will damage the lens.

Terminal

1. Airport currently has 40 gates (10,12,18).
2. Gates are on preferential assignment. They are provided free to airlines. The authority can use free gates in a floating fashion (with airline coordination). This works quite well.
3. South concourse (new) is assigned to United. This means they are leased. New gates will be leased for exclusive gates since leasing is required to fund their construction.
4. There is one itinerant (floating for real) gate. Operations controls it for non-scheduled, etc.
5. There is an authority operations tower. It is manned 24 hours a day and handles snow removal operations, and emergencies.
6. There are no airline towers but each concourse has an airline coordinator. American handles one concourse. United the south concourse (banjo, new one).

General

1. Inbound staging is rare. No formal staging is available; they put aircraft here and there. For this reason, ramp advisories as to gates are not required.
2. Ramp control would be desirable to avoid aircraft hitting a vehicle. Vehicle lines and paths help but violations still cause problems.
3. The ASDE is not located on the tower and has its own tower across the field.
4. Capacity estimates are tough. TCA has been thrown out of Cleveland violently by general aviation community.
5. Airport is landlocked.
6. Limiting factors would probably be gates if general aviation use of the runways could be contained. Expansion plan calls for IFR 95 move/hour, VFR 145 move/hour. Currently, at IFR of 54 move/hour.

7. They are going to 58 gates in the master plan. Mid 60's could be done but not much more.

8. Community pressure on airport expansion is moderate to low.

9. Once capacity is decided upon, gates are established by asking the airlines. They supply their requirements, what they are willing to lease through ATA.

10. Blind spots are not a problem. Since the terminal will not be extended past the current "terminal limit line" and taxiways will not be compressed, future blind spots are doubtful.

11. 5R is now CAT II. This would have to be the CAT III.

12. Cleveland does have ARTS III to be commissioned December 10. It has slipped but is imminent. The ASR is on the field.

13. Interested in the development of lighting standards (e.g. some edge lights inside and some outside taxiway shoulders which sometimes causes an aircraft to get stuck in a soft shoulder).

FAA TOWER INTERVIEW

General

1. It will be at least two years before two ground controllers are needed. They are only now coming out of a traffic slump.

2. Departure queues are typically 5-6. ATC delays are rare and then due to flow control or bad weather at destination. Gates are adequate. Delay control is done on occasion, but rarely. Inbound holding is not staged, not in ramps or in the air.

3. Normally, push back control is done when pseudo inner is involved or when sequencing is necessary. Since gates are adequate, holds are desired there.

4. The bad intersection is 36, 18 and taxiway R.

5. Night operations do offer about a 20% increased work load ("vigilance")

6. Takeoff minima vary but are generally 1600 to 1800 ft. RVR for revenue aircraft.

7. Although there was some question as to whether 5R was currently CAT II or not, it is at least planned.

8. They agreed in general that when surveillance is lost, aircraft are metered almost one at a time. It was stressed, however, that aircraft were also left to their own devices to a great extent.

9. For the most part, they felt the signs were adequate, including the back lighted signs.

10. The centerline lighting problems were standard. Operationally, they were good. There is currently an evaluation in progress for evaluating the CL/ILS settings. Different settings are made and any pilot comments (not solicited) noted.

11. They have some segmented lighting capability (16 switches in the tower). In the past, they have all been turned on. Due to the confusion of pilots and controllers and the power consumption, it has been directed that only those required by the actives be used. The switch panel is archaic.

12. The airport does not have any one way ramps so control is not required. Some pushbacks do enter a pseudo-inner and they are controlled.

13. The tower generally agrees with FAA runway operations forecasts but noted, as did Detroit, the controller strike of last year.

14. The airport is at about 75% capacity now and they could probably manage about 400,000 operations per year. This figure assumes the satellite airports being developed to off load the general aviation aircraft.

15. The limiting factor would probably be gates; it was felt they could "pump a lot more aircraft into the gates right now than the gates could handle".

ASDE

1. ASDE II was installed from about 1963-66. It is no longer in the tower.
2. The ASDE availability record was good. The local controller used it at night even in VFR and the ground controller did also to a much lesser extent. It was used in bad weather, again by both but mostly the local controller.
3. It was felt that an ASDE Brite display would not be used much differently than the ASDE II with the PPI.
4. Although he did not know how ID could be put on a ground display, he thought if it could be, it would be used much more during the day than an analog brite.

DETROIT-METROPOLITAN WAYNE COUNTY AIRPORT (13 DECEMBER 1971)

Lighting/Marking/Sign Systems

1. Airport has edge lighting with centerline lighting on 3L/21R. Centerline lighting improves operations at the cost of increased maintenance with respect to edge lighting. The centerline lighting slush requirement is that the slush be kept below 1/2" on the active runway. Due to the above pavement crown on centerline lighting, a rubber snow blade has been used and proved satisfactory. Concerning installation costs, it is comparable to edge lights if the lighting is put in before the pavement is laid. It should be noted that rubber blades wear much better than steel, therefore, wear is not a problem. Concerning segmented edge lighting, they thought that it would at least be a good way to reduce power consumption. Concerning the sign and marking systems, it was felt that their present setup is adequate.

Blind Spots

1. The last 1 1/2 miles of the final approach airspace into 21R is a blind spot to the local controller. CCTV is used to monitor this portion of the final approach. The setup is adequate due to the lack of alternatives. There is a taxiway blind spot on the taxiway going from near the beginning of 21R to the NE of 21R. The FAA does not take responsibility for ground traffic in this area.

Gates

1. The airport owns everything with 49 gates at present. All gates are well used and are assigned to exclusive airline use, except at the International Terminal. Floating gates tend to present scheduling and service problems (airlines do not necessarily have compatible service facilities).

2. An entirely new International Terminal is now under construction. Completion of the building will raise the existing gate count to 57 and eliminate processing delays presently incurred by international flights.

3. At present, a floating gate scheme is used for the international flights due to the lack of gates for these flights.

Ramp Supervision

There are no airline towers, but American is considering putting in one. They do not see any need for ramp supervision.

Expansion Plans

1. They have recently been told by the FAA that the terminal airspace associated with their airport can accept 560,000 operations annually from Detroit, and 400,000 per year from nearby Willow Run Airport.

2. According to a newly completed study, the forecasted annual operations for Detroit Metro. are:

   1970 - 277,947
   1980 - 357,000
   1985 - 397,000

3. The master plan proposes development of a separate terminal complex, which will add an additional 60 gates.

4. The existing control tower is under contract to be raised 42 ft. This additional height will eliminate all the existing blind spots.

5. The airport's expansion plans are being opposed by the surrounding communities, but the plans are not in the court stage yet.

6. Concerning how gate requirements are estimated, both the airlines and the Commission make separate gate projections and then settle on what the airlines will pay for. One criteria used in estimating the gates that will be needed is that no aircraft should have to wait for a gate during a peak under normal conditions.

7. Presently there are no complaints by the airlines concerning gate availability.

General

1. 3L is a CAT II runway.
2. The take-off minima are on the order of 1/4 mile.
3. The airport has been trying to reduce the percentage of general aviation aircraft to the 15% level by introducing landing fees and requiring a two way radio.
4. The airport is scheduled for TCA and ARTS.
5. The IFR Room is in the Tower and the ASR radar is located on the field.

FAA TOWER INTERVIEW

Staging

1. There are adequate gates presently so that inbound delays seldom occur. When it does occur, the delay is usually spent in the ramps.
2. The primary reason for outbound delay, except for the usual five or six aircraft departure queue during the peaks, is due to a hold on all flights going to a particular destination airport. The most common departure delay is a ten minute separation for all flights passing over Toledo which is to the south.

Blind Spot

1. The taxiway going to the hanger to the Northeast from the beginning of 21R.

Night Operations

1. The ground controller's vigilance increases by 50%

Poor Weather Ground Operations

1. There are no rolling minima. Detroit does not have an ASDE and during low visibility, operations move one aircraft at a time on the taxiway system.

Signs/Markings

1. These are adequate except for the intersection of taxiway H and taxiway J where there is a control problem. Aircraft traveling east on taxiway H toward taxiway J tend to miss the turn onto J and mistakenly roll across runway 3R. This is a very hazardous situation. To prevent this from happening, the ground controller advises aircraft approaching the intersection of the upcoming turn. In spite of this precautionary advisory, aircraft still mistakenly roll across runway 3R about once a month.

2. There is no formal Inner or Outer but only a collection of taxiways of various designations that serve that purpose. This results in more lengthy routing instructions. The Inner is officially called an aircraft movement area by the County.

Segmented Lighting

1. First reaction was that all the switches involved would lead to the controller making mistakes and being confused in general. If the switches were ranged so as to only have a few switches associated with each lighting setup for the various active combinations, there may be maintenance/cost problems.

Ramp Control

1. Ground controller advises aircraft on ramps to prevent a nose to nose situation. There is a need for ramp supervision.

2. Pushback clearance is not required unless the aircraft will enter the Aircraft Movement Area. The Aircraft Movement Area can be seen all the way around the ramp area from the Tower.

Airport Forecast Concerning Operations

1. Operations dipped in FY71 due to airline and controller strikes.

2. 360 to 375,000 annual operations by 1975.

3. 400 to 425,000 annual operations by 1980.

4. Airport is presently gate limited.

Manning

1. A second local controller station will be needed by 1975.

2. A second ground controller station will be needed shortly after. Saturation of the VHF voice channel will be the determining factor.

ASDE

1. An ASDE Brite display would be used only under conditions of low visibility.

2. The controllers would have to live with an ASDE Brite display with ID. In time, they would perhaps find new uses for this type of display format. This type of display would not replace the need for strips which would be the backup mode.

3. Today an ASDE Brite would be most useful to the local controller when he is handling aircraft on 3L under CAT II conditions.

General

1. ARTS III will be operational by 4/72 at the airport.

2. Concerning the split on runway usage, a guess is:

   3L/3R -35%
   21L/21R - 35%
   9L/9R - seldom
   15 - seldom

3. The most popular active configuration is landings on 3L; takeoffs on 3R.

GREATER PITTSBURGH AIRPORT (17 DECEMBER 1971)

AIRPORT MANAGEMENT INTERVIEW

Sign System

1. They are the backlit variety.
2. Sign system is 85% adequate.
3. Airport plans to redesignate all taxiways soon; pilots find present designations confusing.
4. Airport has not looked into either frontlit or reflective signs.

Marking System

1. Use reflective bead paint. Snow plows take off beaded surface in a winter. The centerlines are painted each year.

Critical Intersections

1. Intersection of L and N is a very busy intersection. It has recently been widened to permit two way traffic.
2. At intersection 32 and L a general aviation aircraft has mistakingly missed the final turnoff from 32 onto L at night thinking that 32 connects directly into N. It is a near sheer drop of about 50 ft. This situation will be corrected by means of new light lenses for the threshold lights on runway 32, which will show red to aircraft taxiing down 32 towards taxiway L. These lenses are on order.

Lighting

1. Have bi-directional centerline lighting on the 10/28s. The new 10/28 and its high speed turnoffs will have centerline lighting. The present four high speed turnoffs from 10L also have centerline lighting.
2. The trick to reducing the maintenance required for centerline lighting is in proper installation, the height of the rim to pavement and the epoxy used to install the unit.

3. Plowing is done with a steel blade on the pavement and with a broom for the centerline lighting; this works well.

4. Increased maintenance of centerline lighting with respect to edge lights is in terms of replacing occasional units that are popped out by the snow plows and replacing burnt out bulbs which have beat-up screw heads on the rim.

5. Segmented lighting would be good for guidance but it is not known if the ground controller would take on the added work-load.

Gates

1. 38 gates at present. Gates are fixed except for one gate at the International Terminal. Non-scheduled arrivals are sent to Beckett.

2. New terminal will have 60 gates and will be expandable to 105 gates or more if needed.

3. Present terminal has absolutely no room to add any more gates.

Ramp Management

1. Presently have a dual taxiway around the ramps. The present and planned terminal will have double lanes between the concourses. There is no urgent need for ramp management.

2. Allegheny Airlines has one airline ramp tower at the airport.

Expansion Plans

1. The airport is in the process of adding 6000 acres to its present 3000 acres. 85% of the land has been purchased. It is located ten miles from Pittsburgh, has built the area up and enjoys popular support. The only real community complaint is over use of 5/23 and that runway is scheduled to be closed. The key to this popular support is proper zoning and presenting the truth on the airport's expansion plans to the community.

2. Runway capacity is rated at 660,000. The terminal airspace can apparently accommodate this number of operations.

3. The airport will have 60 gates by 1980 which should double 1970's number of annual operations and increase the number of passengers accommodated 2 1/2 times. The new terminal will be able to handle 16 747's.

4. The final airport capacity will be determined by the runways, not the gates.

5. The new terminal will provide a three minute taxi time, the shortest in the U.S.

Gate Expansion Requirements

1. The airport asks the individual airlines to submit estimates of their future requirements. If the final number of gates is less than the number requested, a formula is used to divide the gates among the airlines.

2. The airport deals directly with the airlines and attempts to keep the ATA informed.

Satellite Airports

1. The City of Pittsburgh also owns the Allegheny County Airport which may handle more business jet flights than any other airport in the world. It is used to keep general aviation aircraft out of their airport. Pittsburgh has landing fees.

General

1. One of the first two airports to try TCA; it will be TCA as of 1/6/72.

2. IFR Room and ASR on site.

3. 1968 traffic mix:
    a. scheduled operations - 60%
    b. GA operations - 28%
    c. military operations - 12%

4. One runway would be certified for CAT II except for the glide slope. Rolling terrain is a problem.

5. A third 10/28 runway is planned, to the south of the existing ones.

6. Terminal capacity will be reached before runway capacity.

7. New terminal will be located in a "hole" and the first floor will be 90 feet below the apron. There should never be a blind spot problem.

FAA TOWER INTERVIEW

Staging

1. The airport could use another 15 to 20 gates. Staging inbound aircraft is a headache for the controller. Inbound staging is done on the Outer, and when wind conditions prevent the use of runway 32, it is also used for inbound staging.

2. Departure queues are no problem except when flow restrictions occur. When this happens, the controller tends to have the aircraft spend the delay at its gate. Flow restrictions are usually for ten minute delays between departures for either Chicago, N.Y. or Washington, D.C. The longest departure queues are never more than seven or eight aircraft.

Critical Intersections

1. The one way link from the intersection of L and N to runway 10L/28R. The runway is sometimes used for arrivals and departures. This requires the controller to meter traffic in both directions on the link. Complicating the situation is the fact that the L and N intersection is constricted due to the proximity of a concourse. The logic used to control traffic over the link and at the L and N intersection is based on runway utilization and is consequently quite complex.

Blind Spots

1. The turn offs on 10L/28R are a long way from the tower and are partially obstructed by a hill. General aviation aircraft tend to completely disappear from view.

2. Night operations are no more difficult than day operations except for the 10L turnoffs.

Weather

1. The airport is open 99% of the time.
2. Weather is usually in terms of ceiling and not range.
3. When fog does reduce visual surveillance the ground controller moves A/C block by block with the A/C reporting in position fixes.

Ramp Supervision

1. The FAA accepts no responsibility for the ramp area and would rather not hear from a departing aircraft before it is ready to pass onto the Outer taxiing area. Calls prior to this time are useful in arranging the flight strips.

Sign/Marking System

1. Signs are seldom used. The layout of the airport is straightforward, and most traffic consists of repeaters. In addition, the taxiway designations are normally not used.

Segmented Lighting

1. The present panel only permits independent control of one segment of taxiway. It is turned off for certain active combinations to prevent a taxiing aircraft from crossing a particular active runway accidently.
2. The Tower would like to have the system more segmented and has requested that the County provide this capability.
3. The runways are always in use. If the wind permits, all the runways are used as actives. If a runway can not be used as such, due to cross wind, it will be used as a taxiway.
4. Annual operations are expected to increase 5% this year and a minimum of 2% each year from then on.

Manning

1. The runways are essentially operated as two airports. The local controller will need a second station in a year or two in order to handle the traffic.

2. The ground controller will need a second station in about three years. It will result from a 10% increase in traffic. Of course, a change in airport configuration may change the time scale.

3. The part time coordinator between the CAB and the TRACON will be full time on two shifts starting 1/6/72.

ASDE

1. The present Brite I is one of the greatest assets a controller has.

2. The airport has never had an ASDE. However, an ASDE with bright display would be very helpful. It is 2 1/2 miles to the end of 10L/28R. An ASDE would be useful with the present airport configuration during CAT II and definitely during CAT III operations. After the present expansion plans for the runways are completed, an ASDE will be needed for CAT I operations.

3. ASDE with ID would be nice to have. If it is a good display, the controllers would eventually use it rather than looking out the window even under good visibility conditions which is what happened with the Brite I ASR.

General

1. Operations
    a. pushbacks from a number of gates block the Inner and for one gate also block the Outer.
    b. 67% of the time the wind direction permits the 3s to be operational.
    c. an ILS is proposed for 32
    d. 28R is primarily a departure runway.
    e. airport has one of the best runway taxiway systems in the country. But the taxiway system, with its incessant closures for repair, handles the daily traffic only because of controller ingenuity.

2. The separation criterion for parallel taxiway operations is at least 30 ft. wing tip clearance.

3. GA operations are 30% corporate aircraft.

4. The primary ground controller problems are:

    a. gate availability
    b. congestion caused by pushbacks
    c. the frequency with which taxiways are put out of service for repairs.

5. The present tower is 92 ft. high; the new tower will be lower.

6. The primary need of the ground controller is for good surveillance. In this regard, a good surface radar is the one sure requirement of ground control.

7. ARTS will be operational at Pittsburgh by 4/72.

8. The airport was desperate for gate space until last month when the west concourse went into operation. However, it is still not uncommon to see four or five aircraft waiting for gates.

9. The Tower is in control of all traffic, such as plows, in the taxiway system.

10. One common fault with field tests is that the controllers involved are not adequately prepared for their roles in the field test which leads to confusion.

LOS ANGELES INTERNATIONAL AIRPORT (11 JANUARY 1972)

AIRPORT MANAGEMENT INTERVIEW

Sign System

1. 747's have knocked over half of the airport's 38 signs. These signs have been replaced by adequately reinforced backlit signs.
2. They have received no complaints concerning their signs, but the signs are very expensive.

Lighting System

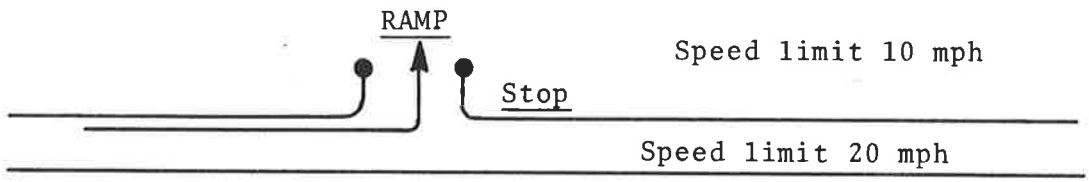
1. No centerline lighting at present
2. Centerline lighting is planned for 24L, 24R, 25L and 25R and for certain high speed turnoffs.

Gates

1. There are 67 at present.
2. They are assigned to the airlines, not leased exclusively. The airport reserves the right to use gates which are available as required. However, they seldom get into the act and let the airlines make their own arrangements.

Marking System

1. Beaded paint was tried but tire scuffing quickly covered it with rubber and it was deemed unsatisfactory.
2. Runways are painted once a month.
3. The ramp demarkation line is not consistent.
4. The ramp service roads are marked with access areas denoted as follows.



Ramp Control

1. The use of the satellite concept makes the control of ramp traffic easier since aircraft can go around the satellite in two directions. However, all of the satellite "go arounds" have been restricted from 747's and DC-110's due to insufficient clearance.
2. Some ramp control is carried out via Company radio.
3. Presently the Tower handles the ramp traffic by means of advisories. This arrangement works well. Only when the controller nears saturation should this arrangement be tampered with.
4. Concerning a gate management system, a form of this system is used at Satellite 2. The Satellite Manager makes up the gate schedule months ahead and then handles perturbations in gate usage via company frequency to the aircraft involved. Communications with the control tower is by intercom telephone.
5. There are no airline towers.

Expansion Plans

1. The present dip in traffic is due solely to the economic slump.
2. The Staff has completed a preliminary study to extend all four runways to the Pacific to aid in noise abatement. This expansion is doubtful due to the steep slope from the present ends of the runways down to the water's edge. It would be a costly project with an imperceptible noise benefit.
3. Airport has 3600 acres. There are five alternative terminal expansion plans. There should be two primary commercial airports handling the LA traffic. Palmdale has been proposed, but it along with all LAX expansion plans are delayed due to the requirement for environmental studies. The delay will be up to 18 months.
4. Presently there are seven satellite terminals.

Areas they would like to see the Program address

1. Surveillance display with ID is the ultimate; anything beyond that is doubtful from a cost benefit stand point.

General

1. The primary ground controller problems are:
   a. ASDE blind spots (these will be eliminated when a converted, light weight, helicopter radar developed by T.I. is installed on the control tower and replaces ASDE).
   b. International flights that have to be led by the hand around the airport quite frequently.
2. Noise abatement procedures are most severe on runway 6L/24R:
   a. Used primarily to handle 747's and Twin Otters.
   b. Traffic held to a minimum from 10 pm to 7 am.
3. Airport is very interested in using split approaches (6 deg/3 deg) to get around growing opposition to aircraft approaching the airport from the east.
4. Ames has approached LAX concerning implementing a hands off CAT III guidance system for AGTC.
5. Real traffic problem is on car side of terminal.
6. Airport has a problem with rubber on the runways which becomes very slippery when wet. The rubber is removed chemically.
7. Clearance should be from gate to gate rather than from runway to runway.

FAA TOWER INTERVIEW

Inbound Staging

1. 87% of the time inbound aircraft find their gates available (a simulation result done for the Authority).

2. Staging is done in air or in taxiways because there is no space in the ramps for a penalty box. In particular, 747's for United can hold in the air for up to an hour waiting for a 747 gate. The gates are scheduled tightly.

Outbound Staging

1. Typical "peak" departure queue is now six or seven aircraft. It was 15 or more in 1969.
2. Holds are taken at the gates with the controller clearing from five to ten aircraft from the gates at a time (emphasis on five). This is encouraged due to noise complaints from surrounding community (which is quite active with respect to the airport) and exhaust emission.
3. Flow control was a problem in the past but it is not serious today, due to the drop off in traffic.

Intersection Control

1. Controller tends to clear aircraft through all intersections implicitly in his routing instructions to the aircraft. The FAA is legally responsible for collisions at intersections caused by routing.
2. A blinking light is used to prevent taxiing aircraft from absently rolling across runway 7L/25R on taxiway 42-J. There has been no such incidents since the light was installed.
3. Suggested areas for a local autonomous controller are:
   a. In place of the present blinking light for runway crossing control
   b. At intersection of K with taxiways 47 and 49 due to congestion
   c. A controller in the CAB suggested the link on 47 between P/L and T/R to prevent nose to nose conditions.
   d. On Twy. 3 before crossing 25R for runway crossing control.
4. Suggested control lights modeled after street traffic lights.

5. The general response to the idea of an autonomous local controller was strongly favorable.

Surveillance

1. There are no serious visual blind spots.
2. There are serious ASDE blind spots and some of them have been disclaimed by the FAA.
3. Takeoff minima are 1600 ft RVR.
4. Night operations increase controller workload by ten to fifteen percent due to loss of depth perception and "strange" aircraft needing help. In addition, good simple airport layout is responsible for this.

Sign/Marking/Lighting Systems

1. Have backlit signs at all intersections and have heard no complaints concerning them.
2. They presently have no centerline lighting. All lighting is edge with directional control on the landing runways and five intensity steps. They plan to put centerline lighting into the arrival runways and the associated high speed turn-offs, and possibly the taxiways between the North and South duals (1 1/2 to 2 years off).
3. Airport taxiway/runway lighting panel has a separate switch for the lights associated with each runway and for various portions of the taxiway system. However, they do not practice segmented lighting.

Ramp Supervision

1. Tower does issue pushback advisories.
2. Ramp supervision is desirable.
3. A gate management system would be nice to have but the money should be spent on more important items. Typically, the ground controller will ask the pilot for whatever gate information he requires. The reverse case is rare except for international flights.

Manning

1. The airport has gone from two local and two ground controllers down to two local and one ground controller due to the slump in traffic.

2. The airport went to two ground controllers in May 1968 due to both controller workload and the saturation of the communication channel. The operations level was about 1600/day or 560,000/year. This was before the South Terminal existed. With the addition of the South Terminal, and at 650,000 operations/year, both ground controllers were fairly busy. Now, back at 550,000 ops/year one seasoned controller can usually handle the whole complex. When two ground controllers were on, one ground controller handled the South Terminal with its five satellites and the other controller the North Terminal with its one satellite. 70% of all traffic is handled by the South Terminal.

3. When the two ground controller set up saturates, the Tower will have to start metering traffic and to perhaps have a separate ramp controller.

4. Presently, the second ground control station is on standby and last was manned two months ago.

Airport Growth

1. The airport is presently gate limited. The runways could handle a million operations a year, 205/hour.

ASDE

1. ASDE has extended blind spots.

2. The tower has two ASDE PPI's, one of which has a TELCO which permits communication with the various controller stations.

3. The ASDE is only used during low visibility operations. During daylight, an assistant keeps his head in the ASDE and keeps both the local and ground controllers advised via TELCO. At night, the hood is taken off the ASDE and the ground controller takes over the role of the assistant.

4. The use of the ASDE is split 50-50 between the ground and local controllers.

5. The ASDE has maintenance problems and an associated high cost. For this reason, they keep the ASDE off unless it is actively being used.

6. Its availability is good but it requires a lot of manpower to keep it up.

7. ASDE Brite could be used at night under good visibility conditions (a qualified yes).

8. ASDE with ID would be used all the time.

Areas they would like to see the Program address

1. They would like to see a good surveillance radar developed.

General

1. Tunnel under airport is not stressed to hold departing 747's. The 747 is restricted from using 25L and 25R and can only cross over the tunnel on a taxiway if empty and under tow.

2. Concerning the need for a CAT II runway, it was noted that CAT II conditions seldom occur. Fog is common; and when it occurs, conditions drop from CAT I minima to CAT III.

3. Maximum peak hr. was 168 ops.

4. All operational positions work within the TCA program, but there is no official "TCA position" at Los Angeles International.

5. Have a manned helicopter position which handles helicopters both in air and on ground.

6. Local control station has two CCTV fixes on the approaches to the 25's. The trouble is fog, not obstructions. The Tower has found them useful.

7. The daily traffic rushes, which are small now relative to the late 60's, are:

    a. departure rush - 9 am and 1 pm
    b. arrival rush - 6:30 to 8:00 pm

c. Operations are now from 70 to 90 ops/hr; it reached 125 ops/hr in the past.

8. TSC observations on ASDE in the CAB were that the resolution was very good particularly in view of the long run between the antenna and the CAB. The wide bodied jets were easily distinguished from the medium jets and the medium jets from the general aircraft. The blind spots are extensive.

9. A general observation on ASDE is that it is sensitive to "tweaking" which can lead to a wide variance on the performance evaluation of a particular ASDE by casual observers.

10. A general observation on surveillance in poor weather. The tower did not feel that CAT II would bring many more operations into the airport. They very rarely are in CAT II since when the fog rolls in it closes in so fast that in going from CAT I to CAT III it is in CAT II only briefly. This has also been the experience of Seattle and O'Hare.

11. In regard to rubber removal from runways, a chemical solution is used which has proven to be very effective; however, this must be done about every two months.

PHILADELPHIA INTERNATIONAL AIRPORT (16 DECEMBER 1971)

AIRPORT MANAGEMENT INTERVIEW

Signing/Marking System

1. There are too many signs at the airport already. In addition, the sign standards are too high resulting in high cost maintenance.
2. Reflective markings have not been considered.

Lighting

1. Centerline lighting will be installed in the new 9/27 and in its high speed turnoffs. When the present 9/27 is refurbished, it will be given centerline lighting. Edge lighting will also be present on these runways.
2. The 747 is an airport destroyer. The inboard engines knock down edge lights at rotation and the outboard engines dig holes.
3. Snow removal is no problem with respect to edge lights.
4. Segmented lighting would be good, but it would increase controller work load. It was suggested that one switch turn on an entire active runway/taxiway combination and then additional switches be used to modify the lighting as desired.

Blind Spots

1. Airport plans to locate a new tower on the south side of the airport. This will eliminate the present blind spot and any foreseeable blind spots due to terminal expansion. The tower will be approximately the height of the present tower.

Gates

1. The airport presently has 45 gates. Each additional concourse will add 11 gates. The final terminal configuration will have 88 gates. This number should be reached in the 1990's.

Ramp Control

1. Presently there are one way lanes between the concourses. The Tower handles the ramp traffic now whenever it becomes necessary. More formal ramp supervision may be necessary one day but they have not given it any thought.
2. There is one penalty box in the ramps.

General

1. The airport is rated at 45 operations/hr. but handles up to 80 operations/hr. on occasion.
2. The airport is presently runway limited, not gate limited.
3. Gate assignment is based on a preferential agreement. Gates are not leased.
4. Airline scheduling is the key to airport capacity. The problem is that the airport has no way to influence this scheduling.
5. Opposition to the airport's expansion plans is isolated to areas outside the city of Philadelphia. The city of Philadelphia strongly supports the airport financially through bonds. The last bond passed two to one.
6. Opposition to the North Philadelphia Airport is very strong.
7. The airport determines future gate requirements by requesting the individual gate requirements from each airline. Concerning gate allocation, the airlines work out a plan cooperatively and then submit it to the airport.
8. The new 9R will be CAT II. The 9L ILS will be shifted to 9R. 27R will keep its ILS.
9. Company service vehicles are being radio equipped by more and more airlines.
10. The Commission has a two way radio setup with its ground vehicles. A transmitter/receiver is at the ground control station.

11. CCTV was used to monitor a blind spot years ago but it was unsatisfactory for night operations.

12. The mix of general aircraft A/C is presently at 36%. The airport would like to see some of this traffic use other local airports such as the North Philadelphia airport, but has had little success to date.

FAA TOWER INTERVIEW

Staging

1. Controllers have to do some departure delay control. Typical peak departure queues something less than ten aircraft.

2. Inbound aircraft normally do not have to wait for a gate - even during traffic peaks.

3. There is a penalty box in the ramp area.

Critical Intersections

1. No taxiway intersections.

2. Runway intersection of 27 and 35.

Blind Spot

1. The feeder taxiway to Runway 17

Night Operations

1. Controller workload increases from ten to twenty percent.

Low Visibility Ground Operations

1. Controller conducts surveillance by means of VHF channel and by allowing only one A/C to roll at a time in a particular area of taxiway system.

Take Off Minimum

1. 1600 ft RVR for Runway 9.

Tower Height

1. 92 ft.

Signing/Marking System

1. Marking inadequate and not extensive. Pilots unfamiliar with airport do get lost due to lack of signs. Backlit signs are used and the type is satisfactory.

Lighting

1. No centerline lighting on field.
2. The new 9/27 runway will have centerline lighting along with its associated exit taxiways.
3. Segmented lighting is not needed for the present airport layout.

Ramp Supervision

1. It is an increasing problem. Noted a fight that took place on ramps between airline service crews. The Tower presently advises aircraft on pushback and on potential nose to nose conflicts in the ramp area.

FAA Growth Forecast (360,000 annual operations by 1982)

1. Tended to agree with this estimate.

Runway Expansion Plans

1. By the spring of 1973, the new 9/27 will be completed. At that time, the present 9/27 will be closed for one year for rehabilitation.
2. The present airport is landlocked.

Terminal Expansion

1. The present terminal can be expanded to some 70 odd gates.

Manning

1. The Tower has requested a second ground control station due to VHF channel saturation.
2. The Tower has an assistant local controller (no frequency alloted to the position) due to surveillance saturation of the one local controller. The primary active runway configuration utilizes intersecting runways.

ASDE (based on experience at JFK with ASDE)

1. Used by both the ground and local controllers during poor weather and night operations.
2. The ASDE was available most of the time when needed.
3. ASDE with ID would be used no differently than the present ASDE.

Areas they would like to see the Program address

1. Problems with ground traffic are not serious enough yet to have been given any thought; there are too many other problems demanding attention.
2. A reliable ASDE Brite display perhaps with ID, will be all that is needed until III/B when guidance problems will develop.

General

1. Take off restrictions due to flow control are difficult to handle when the departures are using runway 9 with its one feeder taxiway. The ground controller tends to separate the departing aircraft by restriction and to hold the aircraft in queues before they enter the one way feeder taxiway. Then he mixes them prior to entering this taxiway so that the restrictions on flow are satisfied. If a restricted aircraft is in takeoff position before it is permitted to takeoff, the aircraft is taxied down the runway to an exist and must go through the entire process again.
2. Ramp service traffic is presently undisciplined and requires the ground controller to be on-guard.
3. There are guidance problems today with patch fog. The runway may be above minima but patch fog off the runways may give the taxiing aircraft enough trouble so that a lead-in vehicle is needed.

4. Active runway combinations:

   a. General aviation aircraft on 17 and the aircarriers on 9 is the best active configuration

   b. 27 and 35 is the poorest active combination

   c. Both 9 and 27 have an ILS

   d. One taxiway feeds 9

   e. Three taxiways feed 27

   f. The airlines prefer 9 to 27 as they have found it more economical.

SEATTLE - TACOMA INTERNATIONAL AIRPORT (12 JANUARY, 1972)

AIRPORT MANAGEMENT INTERVIEW

Sign System

1. The airport has no signs.
2. The airport has 80 new guidance signs of the front-light/747 stressed variety in storage. The airlines requested that no signs be installed as they would tend to clutter the airport. The airport plans to install some of the signs for the CAT II runway.

Lighting System

1. There is bidirectional centerline lighting in runway 16R, which is fitted out for CAT II operations, and its associated taxiways to the ramps.
2. The centerline light units have problems and require nightly maintenance. The airport has been working with the manufacturer to correct these faults and has recommended some fixes.
3. The airport usually gets around five (two to three inches) snowfalls a year. They clear the snow riding on their plow shoes and use a broom for the centerline lights. They have not lost any centerline lights.

Marking System

1. The airport paints the service roads twice a year.
2. They tried beaded paint and tape but due to poor results, it is no longer used. It tended to get dirty and the tires tended to breakoff sections of it.

FAA Tower

1. The tower is presently 98 ft. They plan to raise the tower 20 ft. in order to bring the runup area to 16R into full view. The pavement in this area is blocked from sight of the tower by a low hill.

Gates

1. 32 gates currently.
2. Two gates are open, and the rest are exclusively leased. The airlines work out cooperative use of the gates among themselves.
3. Their gates are well utilized.

Ramp Supervision

1. The airport has no airline towers and none have been proposed.
2. The airport uses citations to keep ramp traffic in line. The ramp traffic is well disciplined.
3. The FAA Tower assists with pushbacks. They can not foresee that the controllers will ever have trouble with traffic in the ramp area.

Expansion Plans

1. They estimate that the airport will handle 155,000 operations during 1972.
2. They doubt the FAA's forecast for 240,000 operations by 1980. They believe that the growth in passenger levels will be accounted for by a relative increase in the number of jumbo jets and only in part by an overall increase in the total number of operations.
3. The airport is landlocked. It was built on a leveled plateau and is bounded on three sides by steep drop offs and on the fourth side by a highway and a commercial area.
4. Two satellite terminals, each with ten gates, will be completed by September of 1972 bringing the gate count up to 52. This should be ample until 1975 when five additional gates will be added to the two satellite terminals for an ultimate total of 62 gates. The recession may put this addition off until 1977. The final configuration will have ten gates for wide-bodied jets.

5. Since the airport is landlocked, the present runway configuration will never be expanded; the airport will ultimately be runway limited. Its PANCAP is 260,000 operations per year. Presently, the limiting factor is the fact that only 28 arrivals and 20 departures of IFR flights can be made per hour. This is particularly a problem for this airport since it handles commercial and commuter taxi flights primarily.

6. In addition to this reduction in capacity due to the limit on the number of IFR flights that can be handled by the runways, the capacity is further reduced by ATC noise abatement procedures which add as much as eight minutes for some aircraft in departing the terminal area. The capacity is still further reduced due to the fact that Seattle - Tacoma is in line with three other airports and must therefore share its terminal airspace with these other airports.

7. Opposition to the noise of approaching and departing aircraft is getting stronger. Noise abatement procedures are here to stay.

CAT II Operations

1. Runway 16R has been equipped by the airport for CAT II operations and is presently waiting for the FAA to put in its equipment such as approach lights and a CAT II rated ILS.

2. CAT IIIA has not been considered by the airport. No criteria exist yet.

Areas they would like to see the Program address

1. An aid for pilots to sense the edge of taxiways, with centerline lighting only, is needed. At their request for such an aid the FAA suggested that they paint a line similar to the present centerline marking to mark the edge. They considered that this could be potentially confusing to pilots and are still seeking a solution.

2. A visual signal at the threshold of approach runways to indicate to an approaching aircraft that a runway is closed.

General

1. Low visibility conditions at the airport are primarily due to fog. In fog, visibility drops rapidly from CAT I to zero-zero. A CAT II airport rating won't therefore, significantly add to the number of operations handled.
2. Markings in the ramps are broken yellow lines to differentiate them from the solid yellow lines used in the taxiways.

FAA TOWER INTERVIEW

Staging

1. Inbound staging is an increasing problem that should be helped when the 20 new gates become operational in 1972. Staging is usually for a minute or two in the ramps or in the taxiways next to the ramps. Gate delays are seldom taken in the air. During bad weather diversions may have to wait an hour or two for gates.
2. Outbound staging is rare even during the daily peaks. Flow control rarely affects them. During bad weather, as many as 20 aircraft can be waiting to takeoff.

Intersection Control

1. The intersection of taxiway B8 with the inboard runway was noted as a busy intersection.

Surveillance

1. There is a blind spot concerning the threshold of runway 16L.
2. Night operations increase controller workload by about 20%. The controller must work harder to maintain safe operations.
3. The takeoff minima are 1200 RVR and 1000 RVR.

Signs

1. The lack of signs is a problem particularly when the controller is trying to direct a stranger around the airport. They have had no formal complaints from the airlines.

2. They have requested signs from the Department of Aviation.

Lighting

1. Centerline lighting marks the first turnoff from runway 34L. Air taxis complain that the centerline lighting beam is too narrow causing them to miss this turnoff.
2. Snow causes no operational problems with the use of centerline lighting.
3. Lighting panel in CAB is poorly organized and is not labeled. All lights are on at night.

Ramp Supervision

1. The CAB is notified of pushback only, it does not require that permission for pushback be requested.
2. Concerning ramp supervision, the CAB does it now as an advisory and is willing to formally take on added responsibility. Ramp supervision should be left to the experts - the FAA.

Manning

1. Full CAB manning is a:
    a. Local controller
    b. Ground Controller
    c. Flight data/clearance delivery controller
    d. Supervisor/coordinator controller.
2. They have requested a clearance delivery and a coordinator in the budget.

Expansion Plans

1. The ultimate limit on capacity will be gates.

ASDE

1. ASDE has adverted three runway accidents.
2. Its availability has been good.
3. The ground and local controllers split use of ASDE.
4. ASDE is presently used in poor weather and it is policy to use it at night.

5. During a recent storm, ice on the dome cut out the southwest quadrant for some time until it melted.

6. ASDE Brite would be used for poor weather and night operations.

7. ASDE with ID would be used for poor weather and night operations. It might reduce the coordination needed between the ground and local controllers.

Areas they would like to see Program address

1. They would like to see a good lighting panel.

General

1. September 1972 the completion date for the CAT II ILS.

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