The “Dump Plan” Reducing American Airlines’ DFW Diversions

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History of “Dump Plan” (Intro-2025)

- Developed in 1991 by Mike Irrgang – AA Flight Operations Technical
- Basic concept to reduce flying and disruption during diversions
  - Also increase safety by reducing air congestion in bad weather
- Was presented to FAA with a very positive response
- Tested once in 1992 and once again in 1993
  - Successfully reduced problems from two waves of thunderstorms
- Was not fully implemented
  - Nervousness about increase in technical stops
  - Changes in SOC management erased idea from institutional memory

Why Try the "Dump Plan" Today? (Intro-2025)

- **Original concept still valid**
  - **Can significantly reduce disruption time as well as recovery time**
- **A new importance to one key benefit**
  - **The "Dump Plan" reduces fuel consumption by two hours per diverted flight**
  - **Assume 50 diversions, B-737**
    - 50 x 5,000 x 2 = 500,000 lbs. = 75,000 gals. x $2 = $150,000 fuel savings per application
- **Now, the original presentation … August, 1991**

A New Approach to Irregular Operations
Improving Operational Predictability at DFW/ORD
What is the Problem Definition

- **Today, there are approximately 30 days per year at DFW and 50 days per year at ORD when there are weather-related diversions. Of these days, approximately two thirds of them have enough diversions.(>10) to cause a major Irregular Operation.**
- **An Irregular Operation results in the system being out of balance. Aircraft, crews, and passengers are in the wrong cities. Many crews are illegal.**
- **The mode of repairing the disruption caused by an Irregular Operation today requires that the following set of priorities (among others) be followed, in this order:**
  - **Do whatever it takes to fly tomorrow's schedule**
  - **Fly today's mission critical flights (critical for either marketing or system balance reasons)**
  - **Bring aircraft back into balance**
  - **Bring crews back into balance**
  - **Get passengers to their destinations**

Irregular Operations
What are Some Impacts?

- **The average number of weather-related diversions in 1989 and 1990 was approximately 115 per month, system-wide.**
- **Taking into account recovery from major Irregular Operations, there are the following direct impacts from diversions:**
  - **Approximately 2 1/2 hours extra flying time for each diverted flight (holding, then diverting, then returning)**
  - **Up to 4 hours before the recovered flight returns to the hub (if it returns)**
  - **An average of 1.6 cancellations per diverted flight, to deal with gate congestion and to bring system back into balance.**
  - **An average of 0.7 ferry flights per diverted flight. These average 78 minutes in length.**
  - **Taking into account typical load factors on the diverted and cancelled flights, about 400 disrupted passengers per diverted flight**
- **<u>The full costs of Irregular Operations are unknown today</u>. In particular, we do not know either the direct or indirect (e.g. loss of future business) costs of either cancellations or diversions. And the true cost of a cancellation during a weather session will be quite different from the cost of a non-weather-related cancellation.**

Irregular Operations
What are Some Various Areas Incurring Costs?

- **Ferry crew costs.**
- **Crew overtime deriving from the Irregular Operation. Possibly insufficient crews to fly the remaining month's schedule.**
- **Field Services overtime deriving from the Irregular Operation.**
- **Fuel and maintenance costs for operating aircraft, from the delays and holding which preceded the diversions.**
- **Additional maintenance costs due to missed scheduled maintenance checks**
- **Cancellation costs:**
  - **Hotel, meal, and OA ticket costs for cancelled passengers.**
  - **Lost revenue due to cancelled passengers (passengers who walked away, excess over normal no-show factor from normal operations, etc.)**
  - **Lost goodwill cost:**
    - Estimation of lifetime revenue loss from AAdvantage passengers who will switch major flying to other carrier.
    - Estimation of other passengers' lost revenue due to irritation with American.
  - **Baggage mishandling costs.**
- **Additional taxi fuel and maintenance costs due to increased Irregular Operation ramp congestion.**
- **Cargo revenue losses due to load restrictions deriving from the diversions (increased passenger loads on some flights).**
- **Additional SCS transfer pricing costs due to additional DECS and RES transactions between a diversion day (and additional recovery day), and the preceding day.**

Irregular Operations
How Could We Determine the True Costs?

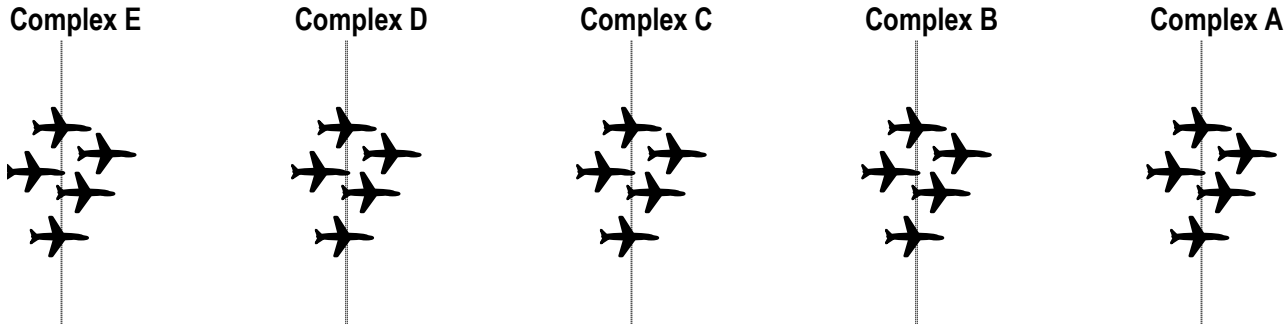
- **Conduct a study, building a team of personnel from:**
  - **Field Services**
  - **Passenger sales**
  - **Airline scheduling**
  - **SOC/Dispatch**
  - **SCS**
  - **AADT**
  - **Operations Planning/Systems Development**
  - **Crew Scheduling/Tracking**
  - **Finance**
  - **Flight**
- **Take a high-diversion day (eg. any day in DFW where there are > ten diversions in one complex) and completely analyze it. Also analyze day preceding the diversions, and two days following the diversions, as it can take two days to bring system back into balance (crews and aircraft).**
- **To truly analyze the passenger/revenue related costs, necessary to identify every passenger who passed through the diversion hub on the diversion day, who did not get to his destination on his originally scheduled flight and within one hour of his original scheduled arrival. Necessary to categorize passengers by factors which identify their degree of disruption, and then to conduct some selected interviews (with particular weighting toward AAdvantage, AAdvantage Gold, and AAdvantage Gold Million-Milers) to determine the total impact on future revenue.**

Irregular Operations
What Really Leads to the Disruption?

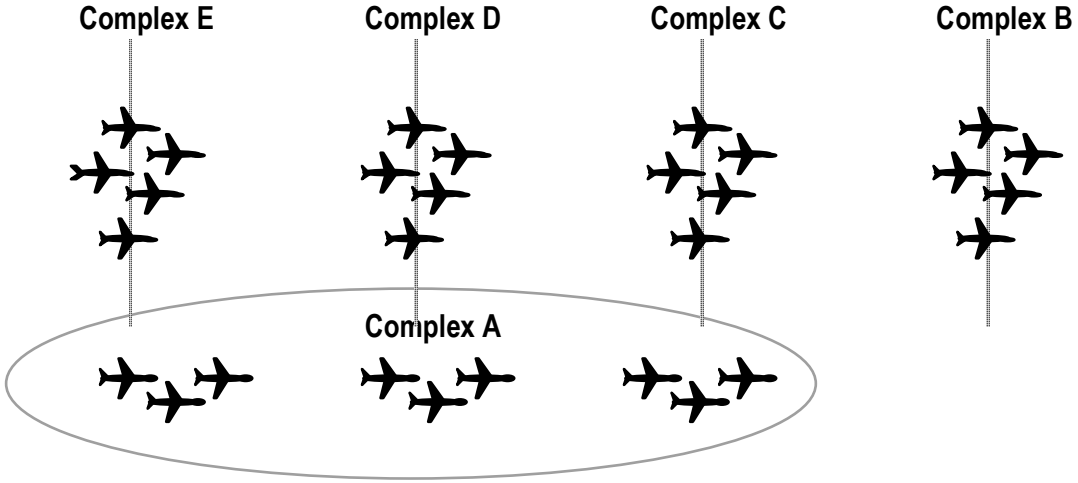
- **An Irregular Operation disrupts the airline because the <u>airline gets out of sequence!</u>**
  - **The next complex may be landing at the same time as the diverted complex is landing at the diversion cities**
  - **Recovery involves processing complexes out of sequence**
- **The act of diversion recovery is going to be constrained by several issues that will vary in particular situations. These are:**
  - **There is a shortage of gates at the hub in each complex. This causes the recovery of diverted flights to proceed at about 10% of a hub's complex size per hour. For DFW, this is 4-8 flights per hour maximum. Diversion situations have frequently resulted in more than 20 diversions for a particular hub.**
  - **The exact timing of the actual diversions will influence the degree of difficulty which will occur during recovery. This principally is a result of two factors:**
    - Crew legality time remaining
    - Variable spacing of complexes
- **The act of diversion recovery is really two separate jobs:**
  - **Keeping the airline running; i.e. processing the current and next complex**
  - **Planning initial diversion recovery starting about two complexes out.**
- **The recovery process becomes constrained primarily by crew legalities,crew availabilities, and special mission aircraft.**

Irregular Operations
Complex Flow Before and After Diversions

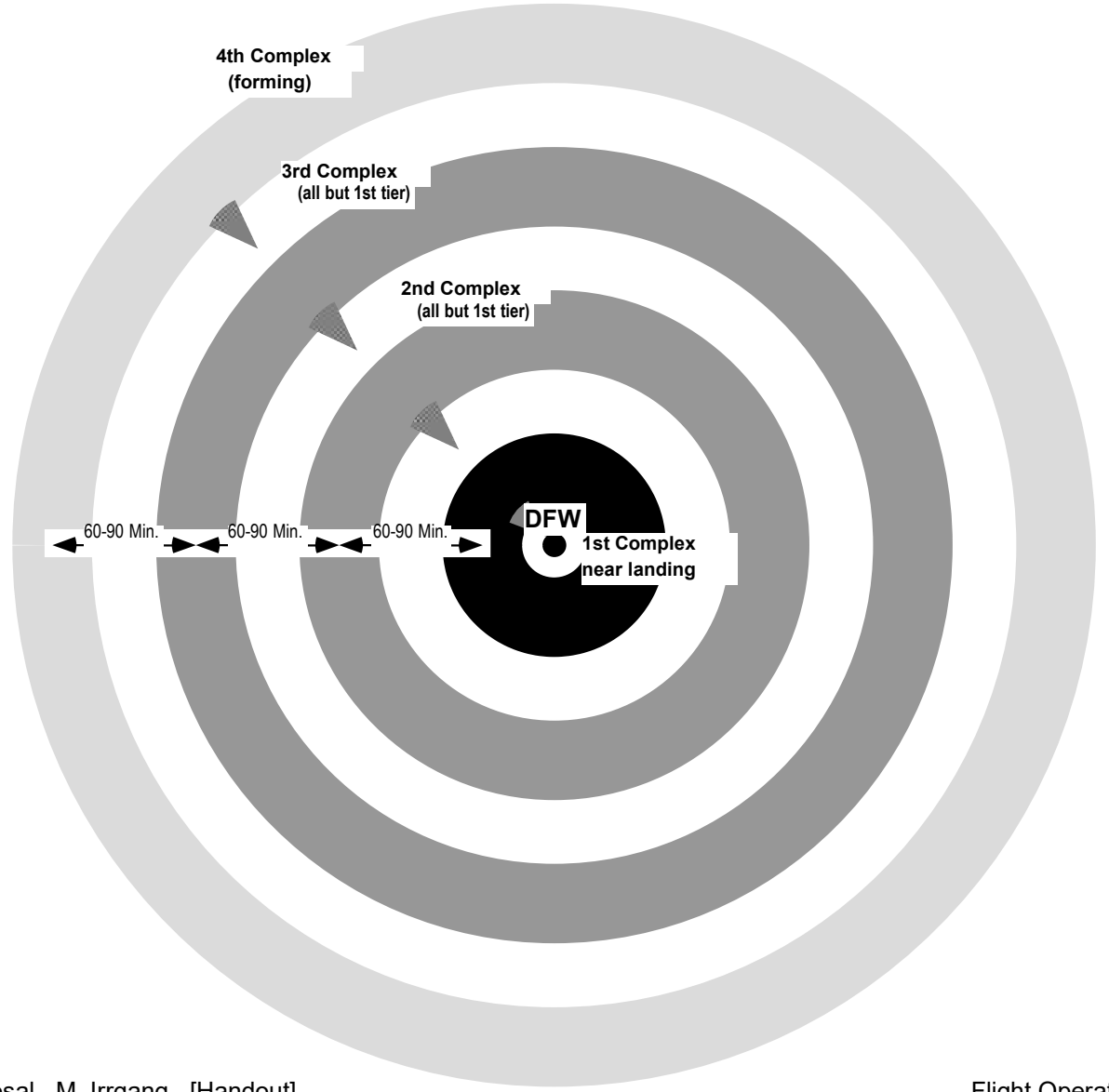
- **Complex flow prior to diverting:**



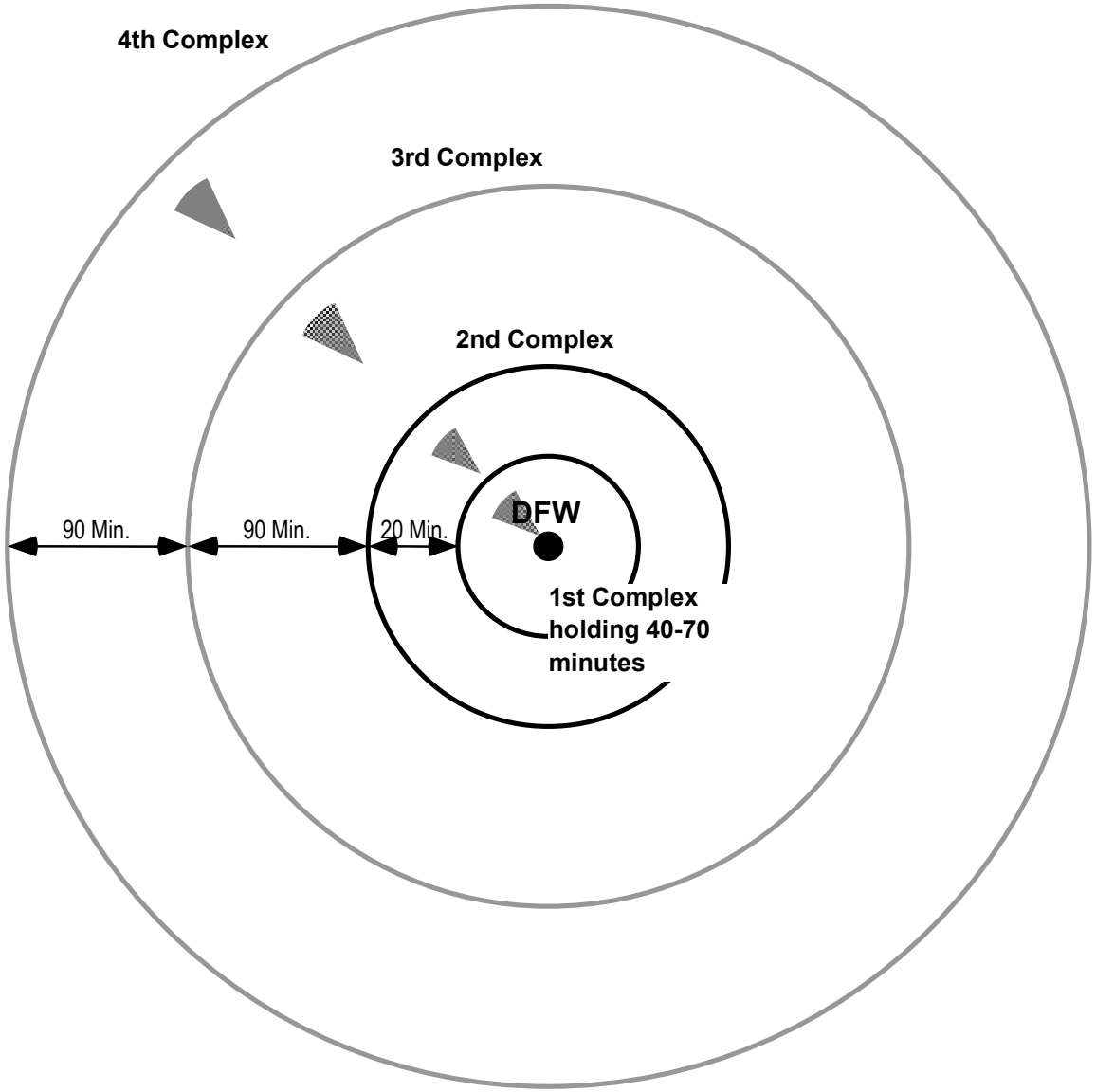
- **Recovery after current approach to holding, followed by diverting. Airline out of sequence, disrupting crews, aircraft, complexes, passengers:**



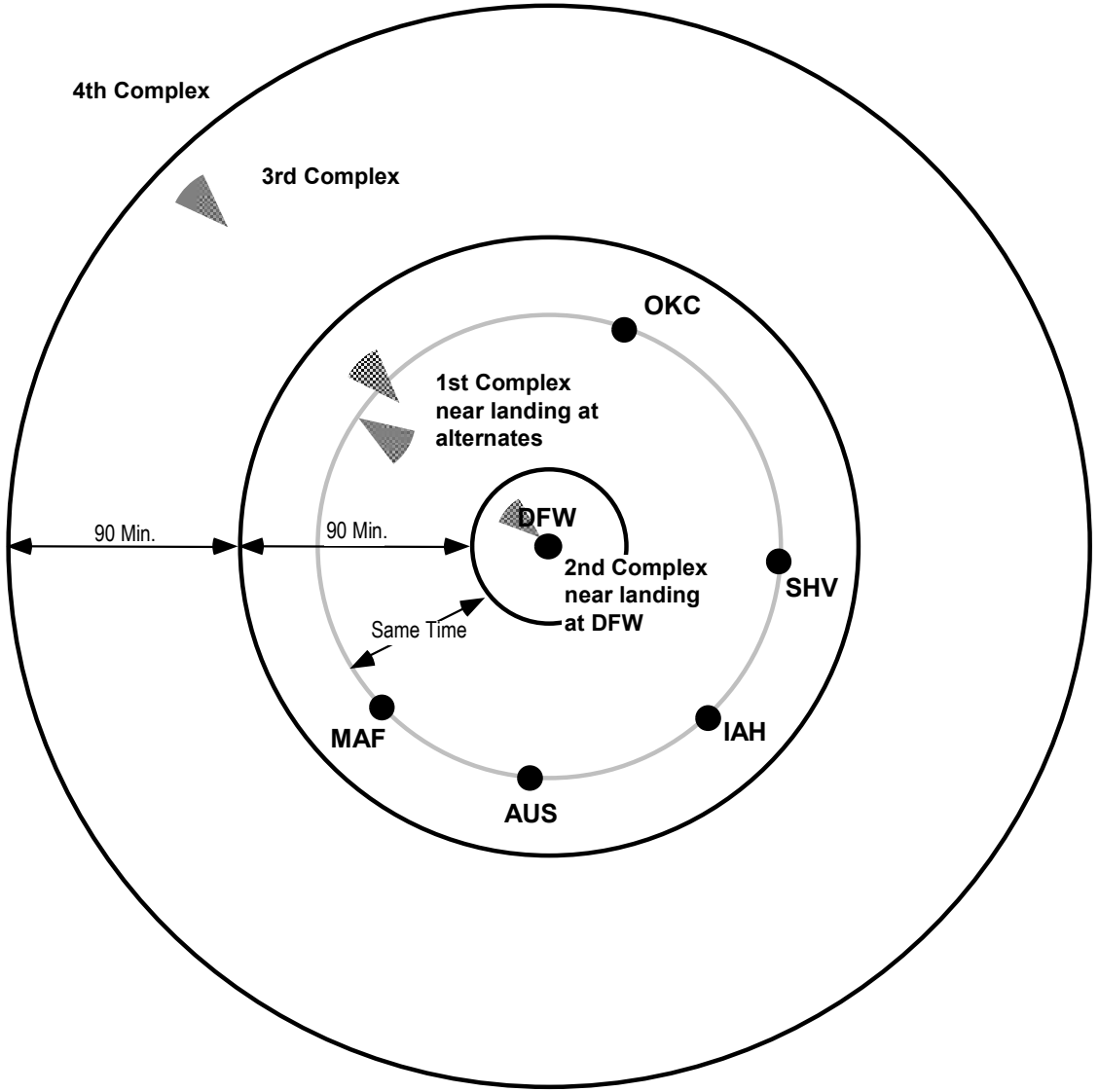
Prior to Irregular Operation
Aircraft in the Air



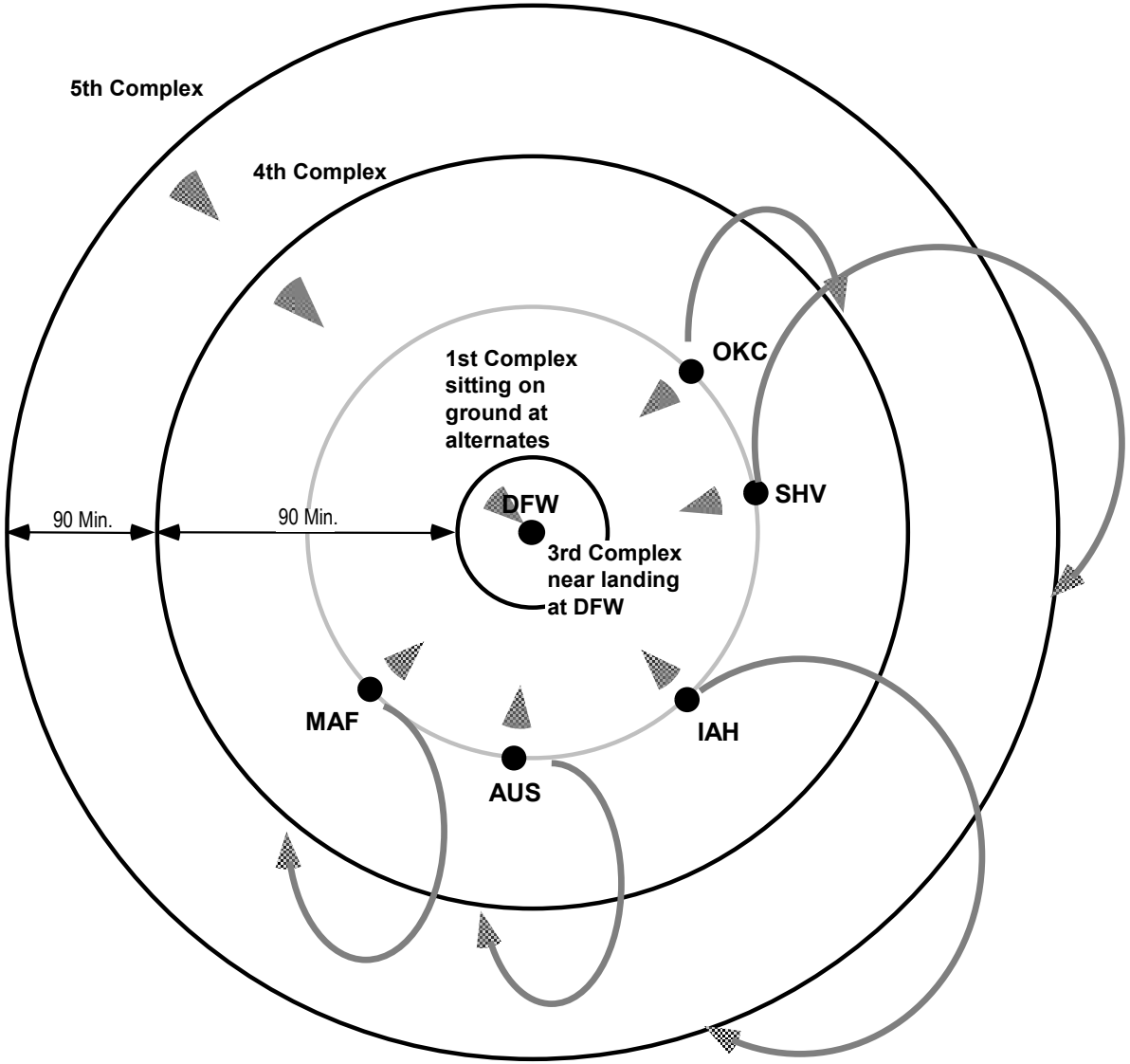
At Commencement of Irregular Operation
Current Approach: Holding



Irregular Operation
Current Approach: When Diversions Land



Irregular Operation
Current Approach: Recovery

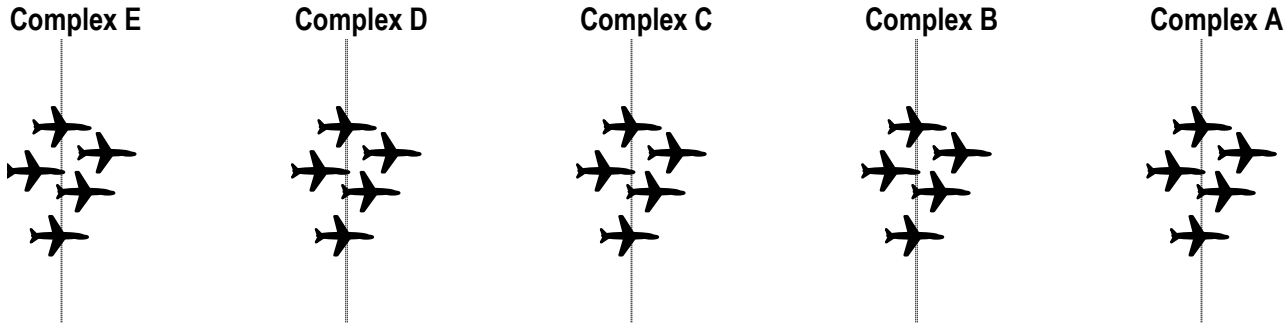


A New Alternative for Irregular Operations
Dump Enroute Instead of Divert

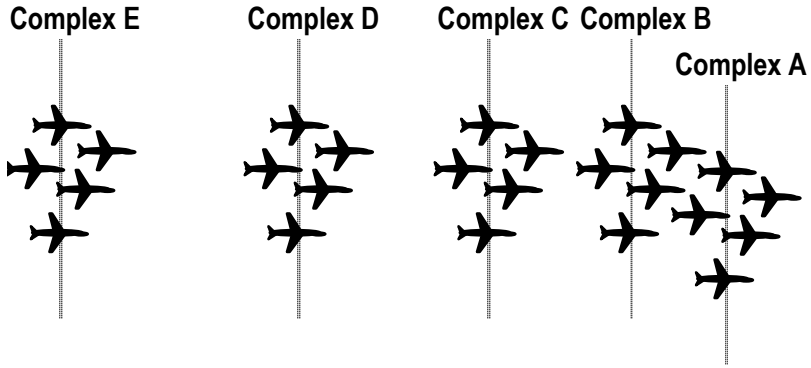
- **Pre-plan enroute first-tier operational alternates for all flights beyond first tier cities. Prepare to implement on a day when there is severe weather forecast for the hub. Prepare multiple flight plans and plan fuel accordingly for all farther out than first tier flights into the hub on that day.**
- **Implement plans to land the entire airborne portion of the next inbound complex if a "ground stop" exists in the first-tier cities when flights have reached approximately 45 to 60 minutes out from the hub (DFW or ORD). The triggering "ground stop" would be for conditions unacceptable for landing, not just for reduced traffic flow.**
- **Land immediately at the operational alternate. Do not hold.**
- **If the complex has already come in past the first tier when a weather situation commences, immediately divert to the operational alternate without holding.**
- **At the interrupted flight destination, do not proceed to a gate, unless required for fueling. Add minimal fuel (3000-5000 pounds) needed to resume flight. Get back into air as soon as receive ATC clearance, after hub opened up again.**
- **Resume flight into hub**

Dump Approach to Irregular Operations
Complex Flow Before and After Diversions

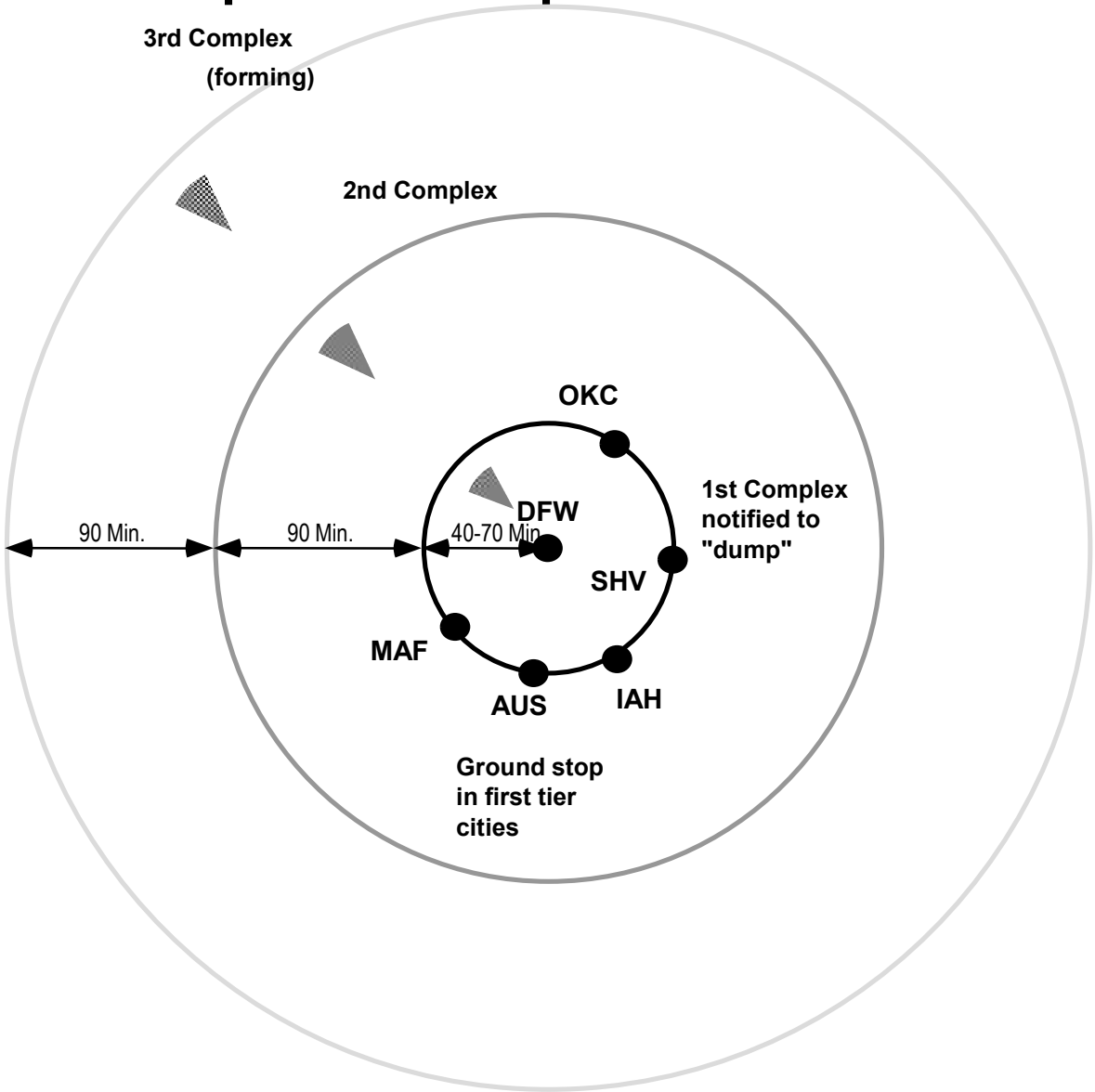
- **Complex flow prior to dumping:**



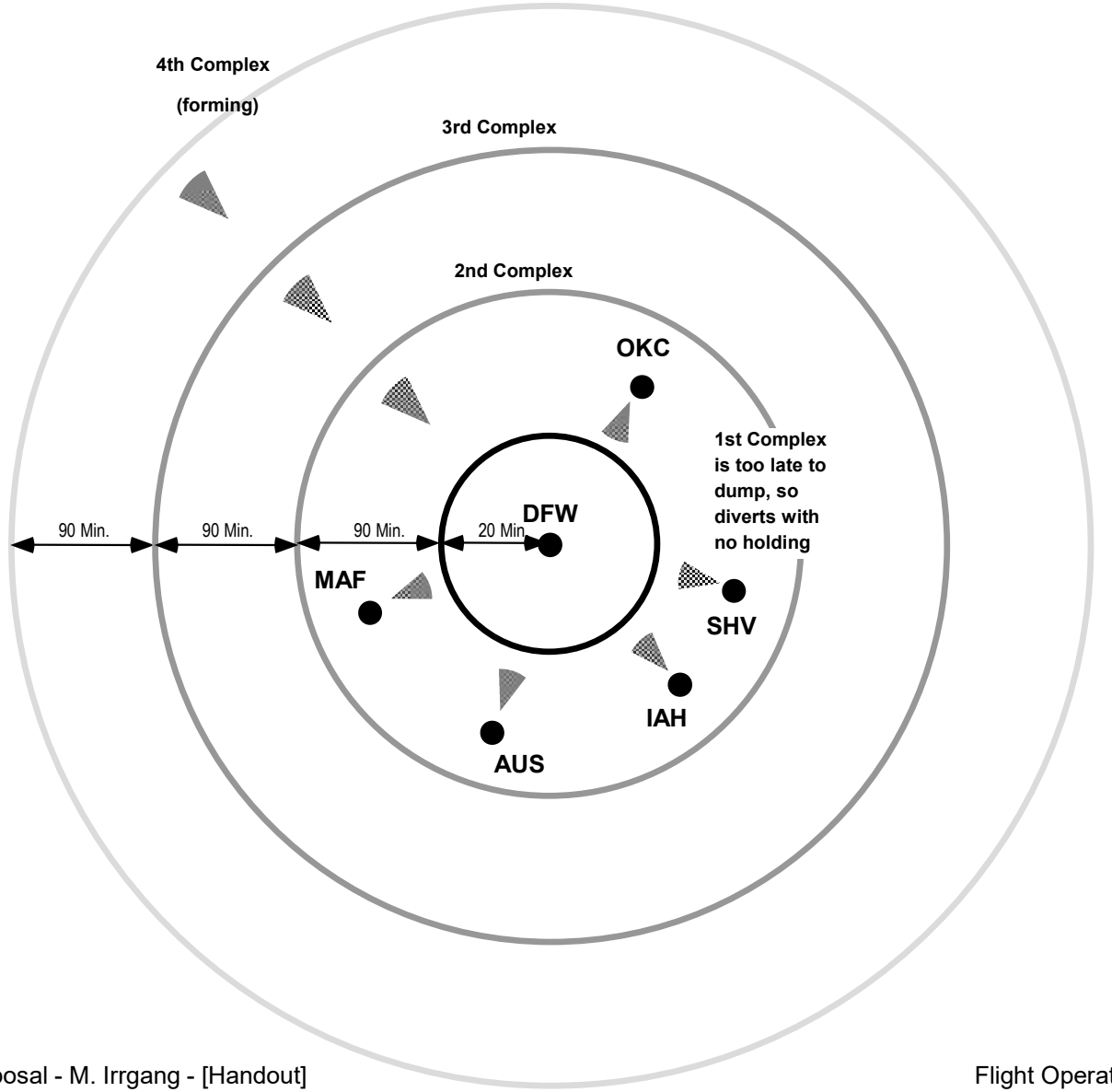
- **Recovery after enroute dumping. Airline (complexes, aircraft, crews) still in sequence**



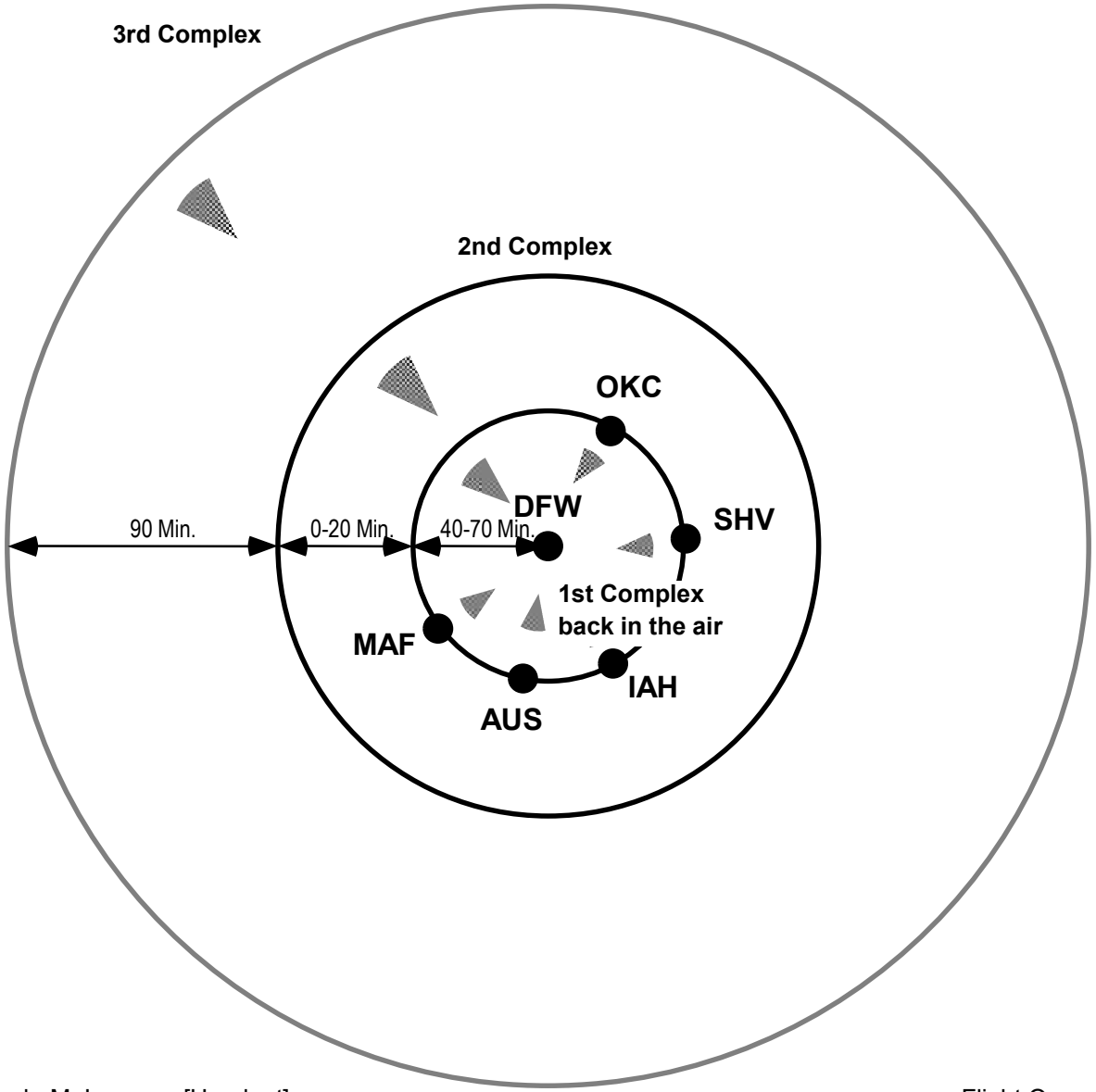
Dump Plan
Prepare to Dump if Near First Tier



Dump Plan
Too Late to Dump (Beyond 1st Tier)



Dump Plan Recovery



A New Alternative for Irregular Operations
Issues Relieved by Dumping

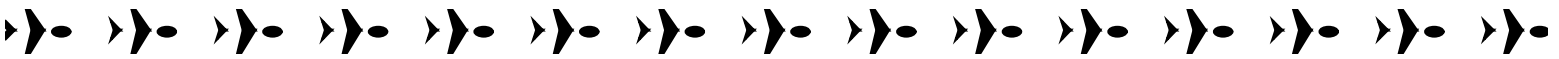
- Airline no longer out of sequence (by definition). All crews will make their connections (where legal). All passengers will make their connections (by definition).
- Reduced crew illegalities. Today we have a "window of illegality". Diversions around 3-5 pm can cause illegal crews in the alternates, further complicating recovery. This window would be reduced. Most illegal crews would now be in the hub (DFW/ORD) - a crew base - easing recovery.
- Cancellations would now be only necessary where desired. None for system balance.
- Reduced flying per diverted flight.
- Reduced end-of-month crew shortages
- Greater alternate aircraft capacity
  - Do not need massive refueling (3,000 instead of 30,000 pounds) because did not hold
  - Do not need gates, except for minimal time for fueling, because do not need to deplane passengers at alternates

A New Alternative for Irregular Operations
Core Philosophies of Dumping

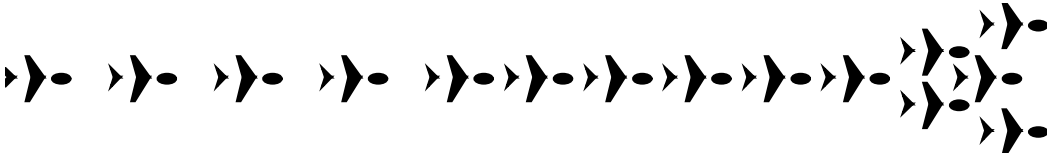
- **The sequence of complexes must be preserved, at all costs**
- **It is acceptable to park on the taxiway at the hub. If a flights is on the ground from Complex "B" scheduled for Gate 23, but the flight from Complex "A" is in the air within 30 minutes of the hub, then the Complex "A" flight gets the gate. Flights can only go out-of-sequence to "spare" gates.**
- **Dumping is initiated when there is a sustained, severe ground stop at the hub from the first tier (a period of > 30 minutes of no arrivals):**
  - **At this point, 1/3 of a complex is destroyed anyway**
  - **Proof that this is valid: we only get diversions a few times a year from the first tier cities**
- **We are trading unknown disruption for certain delays**
- **It is better to have more dumps than we today have diversions, because of the cost savings and reduced disruption**
- **It is better to have delays if they provide the certainty of making connections. We may increase the DOT figures, but we have a marketing counter to that in improved dependability, in a more relevant form of dependability**
- **In effect, the priority of passengers is now boosted in resolving Irregular Operations**
- **Ask any "AAdvantage Gold" - he would rather be delayed up to two hours than not know whether or when he will get to his destination. Uncertainty is what inconveniences him the most.**

Dump Plan
Flow With Continuous Complexes

- **This plan should actually be easier if we go to continuous complexes, as sequencing will be more critical**
- **Normal continuous flow:**



- **Flow during recovery from a dump:**



A New Alternative for Irregular Operations
Questions on Dumping

- **Will this work for all flights?**
  - **No, probably not. But rather than disrupting 2/3 of a complex, about 10% of a complex would probably be disrupted**
- **What if a complex still lands ahead of the previous one?**
  - **Use the spare gates. Then wait to process the preceding complex in order of arrival**
- **What does this do to complex timing?**
  - **A typical situation would be a 30-60 minute airport disruption. This should result in about a 1 1/2 to 2 hour delay. All operations through the hub will now be delayed for the rest of the day. We may possibly be able to make up a few minutes per complex, however.**
- **What if the airport weather disruption is longer than 60 minutes?**
  - **The next complex could also land enroute, if it had to. Eventually, aircraft could be held on the ground at their origins.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What is the impact of ATC?**
  - **ATC will not immediately clear flights to relaunch. On the good side of the weather, there should be about a 30 minute clearance time. On the bad side of the weather, clearance should require up to 60 minutes. In addition, flights on the bad side may need 20 minutes of extra flying.**
- **What is the actual timing of dumping (over and above original flight plan)?**
  - **10-20 minutes to deviate from flight path to land at alternate**
  - **5 minutes taxi in**
  - **20 minutes to refuel minimally**
  - **5 minutes taxi out**
  - **0 minutes before hub accepting traffic again (Note that 40-60 minutes have now been used)**
  - **5-60 minutes for new ATC clearance**
  - **5 minutes additional flying for new ascent**
  - **0-20 minutes to possibly fly around weather**
  - **50-135 minutes total time. As not all flights have maximum, this makes the maximum likely hub delay under a typical weather session (thunderstorms) about two hours**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What is the fueling of flights under this approach? How does it compare to what we do today?**
  - **Flights would be planned for a fuel minimum of a normal alternate plus hold time based on actual historical delays. For example, a flight into DFW might be fueled for AUS + 38. Today, when diversions are possible, flights are often fueled full. If pilots rejected this low fuel, maximum landing weight at alternate could be the determining fuel limit. This would still result in lower fuels than today.**
- **Won't this cause flights to exceed maximum landing weight at their enroute alternate?**
  - **Trying flight plans with typical or heavy loads, this does not appear to cause any further load restrictions than are in use today. For instance, an MD-80 landing short at SHV would have about 2000 pounds to go to maximum landing weight when planned for a 32000 payload**
- **What if this plan breaks down in any given Irregular Operation?**
  - **It will merely degrade into today's common practice. For instance, the worst case would be when part of a first complex arrived, the rest dumped, the third came in, but then the weather deteriorated such that the rest of the first could not get in, all over a several hour period. At that point, we would just have to deal with those aircraft we had in the hub.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What if there were successive waves of weather, hitting multiple complexes?**
  - **The plan should still work, if we just keep on applying it in sequence**
- **What if the weather at the enroute alternate is bad? Is there a safety problem? Where do we divert to?**
  - **There is no safety problem, as in effect, you have 30 minutes additional hold fuel for that destination. We should plan two operational enroute alternates for all flights.**
- **What about holding flights on the ramp or taxiway at the hub? What if most of the passengers had the hub as the final destination?**
  - **There are some such flights. The average percentage of termination at DFW is 30%; however ORD-DFW have 90% termination. These would be the flights that could get the spare gates. This decision can be made dynamically, because there are SABRE commands to obtain this information.**
- **What else could we do to make this even smoother?**
  - **We could get passenger stairs and buses to allow some deplaning of passengers when waiting at the hub.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What if ATC refuses to cooperate?**
  - **We will need to discuss this plan with ATC. It is true that their current operating procedure would cause them to not want to launch our recovery of "dumped" flights quickly enough. However, in negotiating with them, we should point out that under our plan, while the workload of Approach Control would go up, the overall ATC workload would be less, because our planes would spend much less time in the air (elimination of pre-diversion holding)**
- **Is there a communications impact and a dispatcher workload impact?**
  - **Yes. All long-range flights on a possible "dump" day would have to be planned three different ways - to destination, to alternate, from alternate. Also, dispatchers would need to communicate all the "dump" orders to the pilots. More dispatchers might need to be hired. It is possible that manning or overtime might be required at a 25% higher level to handle the additional workload (based on information from NWA). However, automation assistance could be developed to help reduce this load considerably:**
    - A "switch" to generate multiple, fuel-reconciled flight plans
    - A "trigger" to send ACARS "begin dump" messages to all flights affected (and their dispatchers)
    - A "switch" to send AMS messages forecasting possible ruboffs to all concerned parties

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What is the ruboff to other hubs?**
  - **In effect, half the airline becomes delayed, as the day progresses. It should be noted, however, that this often occurs today. The length of the delays which will occur under the "dump" plan may be significantly greater than some of those today, but the number of flights delayed may not be greatly increased. The extreme delays today will be reduced. Cancellations all over the airline would be lower.**
- **Why has the impact of irregular operations on the airline grown over the past few years? Doesn't the growth of the airline give us greater opportunities to fix problems from economies of scale?**
  - **In effect, we have been reducing the number of resources that we have available to repair the operation:**
    - As the airline has grown, we have kept the same number of spare gates at DFW, thereby reducing the percentage of gates available per complex.
    - We have made the schedule tighter, particularly this summer
    - We have gradually been reducing both the number and the percentage of Schedule Protection Aircraft (SPA's), which are necessary to deal with both mechanicals and Irregular Operations.
    - We frequently have short term crew shortages.

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **Would the "dump" plan overload the spoke cities used for enroute landings?**
  - **We would be landing up to six flights per city under this plan. Today, we try to plan half of this per alternate. However:**
    - We occasionally land many more than this per alternate
    - Our processing impact per flight in the alternate would be much lower, because of less planned ground time negating the need for passenger servicing, and higher fuel on board reducing the amount of fueling and gating.
- **Would the additional delays overwhelm our capacity to provide crews?**
  - **If the "dump" plan was implemented early in the day, there would be a higher impact on crews than we encounter today. However, today, when we have crew illegalities, the fact that they are often in the spokes creates additional problems. Also, as we propagated the delay through the day, crews could be notified to start their duty time later several complexes out. The various factors should cancel each other out. The simulation will be needed to totally address this issue.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **Isn't it better to cancel flights before the passenger boards, rather than have him wait on the taxiway at the hub?**
  - **The passenger made his plans in advance, with flights, meeting times, and seat assignments. If he was aware of the weather in advance, many business travellers will have already adjusted either their flights or their meeting schedule in advance of coming to the airport. In bad weather, the business traveller expects delays. An extreme irritant today, however, is coming to the airport, or arriving at a connecting gate in the hub, and being told that a carefully pre-arranged schedule, with an aisle seat or first class upgrade, is now changed, disrupted, with final travel plans unknown, and with probably degraded seating assignment. To alleviate concern of passengers seeing empty gates, we can park on a DFW west side taxiway. In addition, we could cater for additional beverage service on days when "dumping" is anticipated. If this plan works as proposed, we could gain benefit from advertising this new approach to bad-weather flight dependability.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **Is "dumping" a binary decision? Would all flights always dump?**
  - **No. International flights might not even dump at all. Also, the timing could be such that some flights have already landed prior to the dump decision being taken. In such a case, the anticipated timing would govern how the situation could be handled.**
- **What triggers a ground stop? Is it possible to predict?**
  - **The ATC mechanism for ground stopping is as follows:**
    - There is an increase in miles in trail
    - There is a reduction in rate of traffic flow into the hub
    - One or more pilots will refuse to takeoff or land
    - The local center (here, Fort Worth Center) will institute an internal ground stop (affecting some cities, such as AUS)
    - The first tier of ATC centers will institute a ground stop
- **This process can take hours or minutes, and may or may not progress all the way. Maintaining tight communication with the local ATC center could enable us to better predict the likely outcome of any such process.**

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **Are there any overall safety implications of the "dump" plan?**
  - **Yes. When this plan has been discussed with pilots, they have very enthusiastically endorsed it. They would much rather be sitting safely on the ground than indeterminately holding in crowded skies in bad weather.**
- **Are there any other benefits of the "dump" plan?**
  - **Some other benefits are hard to quantify, however they would definitely be apparent, deriving from the emphasis on predictability:**
    - The anxiety deriving from an Irregular Operation today would be relieved, both with passengers and AA personnel. As soon as dumping was instigated, we could notify all affected stations of the flights anticipated for "dump" ruboff delays. We could notify passengers on FIDS of expected delays. As time progressed, of course, the delay times would become exact.
    - We have resource shortages in the airline, but they are hard to quantify, or to identify specificly which ones are the current bottlenecks. As dumping converts all disruption problems into delays, as we accumulated a history of dump analysis, we could identify the magnitude of specific resource shortages.

A New Alternative for Irregular Operations
Questions on Dumping (Cont.)

- **What would be the fundamental problems in implementing the "dump" plan?**
  - **Today, we would have a major problem in that nobody would want to take responsibility for triggering a "dump". There would have to be a strong upper management commitment to the plan, without minimal risk of career consequences for an imperfect decision. "Monday morning quarterbacking" affecting the individuals involved would have to focus not on whether the "dump" decision was the right one, but rather whether it was correct given the information available at the time. Whether or not the decision was correct in the absolute sense should only affect the details as to how we modify the "dump" program.**
- **Are there any critical requirements to "dumping" not met today?**
  - **Automation assistance (mentioned previously) would assist greatly. Also, any time we have disruption, it is important to have additional automation tools to assist us in assessing the full impact of this disruption. However, this is as true today for our current approach as it is for the "dump" environment.**

A New Alternative for Irregular Operations
Summary of Issues Encountered With Dumping

- **Downside:**
  - **More interrupted flights, some with no apparent reason**
  - **Increased/shifted dispatcher workload**
  - **Shifted (though decreased) ATC workload**
  - **More delays.**
  - **Occasional lengthy waits on ramp**
- **Upside:**
  - **Enhanced safety**
  - **Less ferrying, less flying**
  - **Lower fuel cost - less holding**
  - **Lower Ramp Arrival Fuel - less hold fuel**
  - **Fewer crew misconnects**
  - **Lower crew Irregular Operation pay & credit**
  - **Less of an end-of-the-month crew shortage**
  - **Fewer passenger misconnects. Enhanced passenger goodwill**

"Dump" Plan for Irregular Operations
Other Alternatives?

- **We have had difficulties in recovering from Irregular Operations for many years. A variety of different operational approaches have been applied, with varying results. Most improvements have been incremental, rather than major.**
- **We can continue to seek new minor adjustments. If we do, our problems will gradually worsen as the airline continues to grow, and as the skies and airports continually offer more constraints.**
- **Before we seek any major, revolutionary changes, we need to know what diversions and Irregular Operations in general cost us. It will be a major effort to find out, but we need to know in order to effectively analyze cost tradeoffs involved in any new proposals!**
- **We should also start to build a comprehensive Irregular Operations system. We have been looking at some system and technological approaches over the past several years which can provide significant benefits. We should re-examine the need for development of such systems at American.**

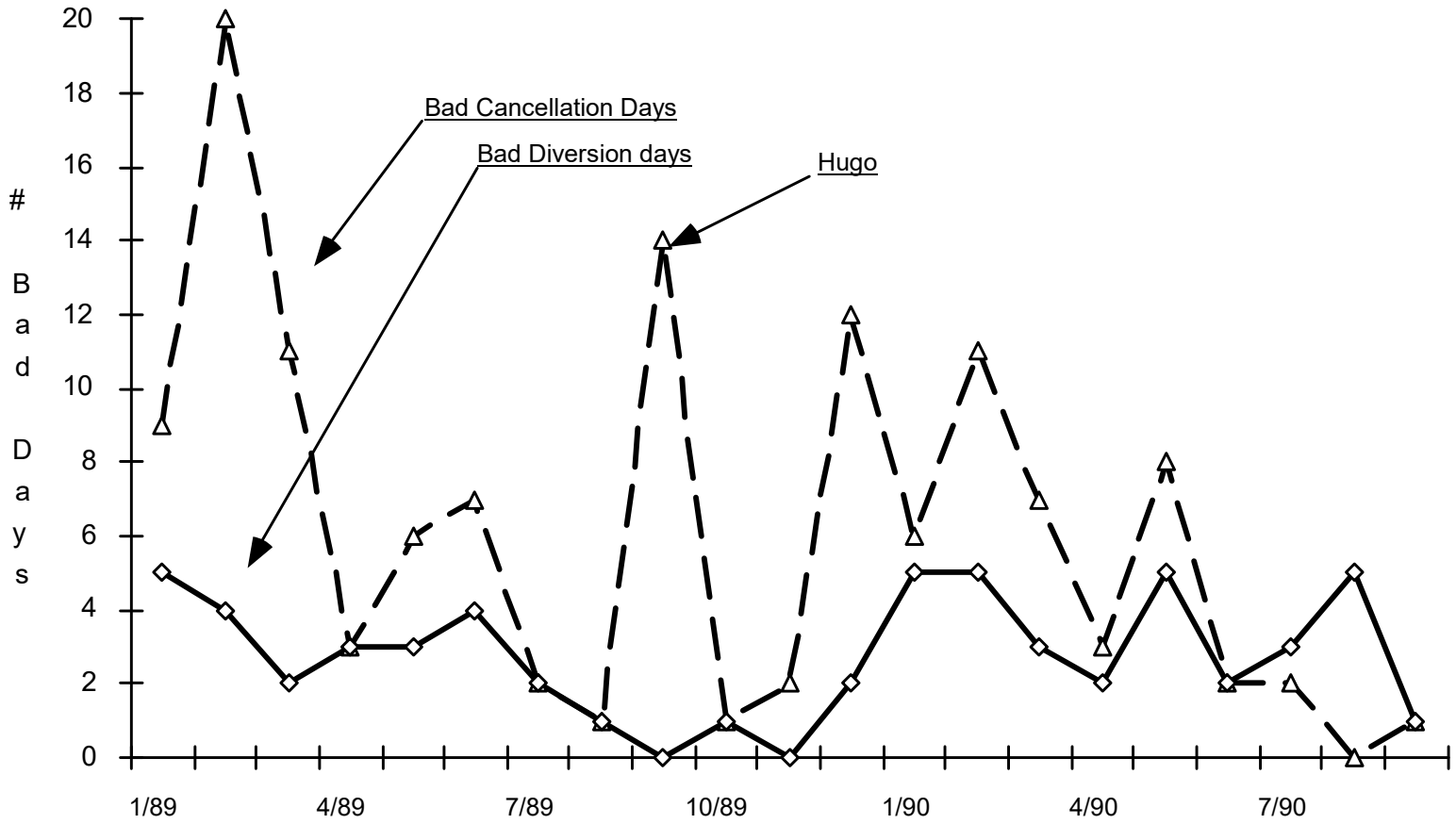
"Dump" Plan for Irregular Operations
Call to Action! How Do We Start on the "Dump" Plan?

- We need to conduct simulations and tests of the "dump" plan. First, we should perform a simulation using TDEC. We would then analyze this thoroughly. This would involve personnel from:
  - Field Services
  - Flight
  - SOC/Dispatch
  - SCS
  - AADT
  - Operations Planning/Systems Development
  - Crew Scheduling/Tracking
- Next, we should perform a limited test, to validate that the plan would not overwhelm a spoke in the real operation. We would perform this test by planning to dump five flights into one alternate on a real diversion day. Careful monitoring would be necessary. The attempt would be made to relaunch as quickly as possible. If there were any problems, they would not impact the current situation, as today we often don't relaunch for four to five hours.
- We would then test "dumping" in the real operation on one day, which we would then analyze thoroughly.
- Before actually "dumping", we need to apprise and collaborate with the FAA on our plans. We would need their cooperation.

"Dump" Plan for Irregular Operations
Call to Action! How Do We Start on the "Dump" Plan?

- **We need to build a team to start studying diversion costs. This would involve personnel from:**
  - **Field Services**
  - **Passenger sales**
  - **Airline scheduling**
  - **SOC/Dispatch**
  - **SCS**
  - **AADT**
  - **Operations Planning/Systems Development**
  - **Crew Scheduling/Tracking**
  - **Finance**
  - **Flight**

Weather-Related Diversions & Cancellations
Backup Information



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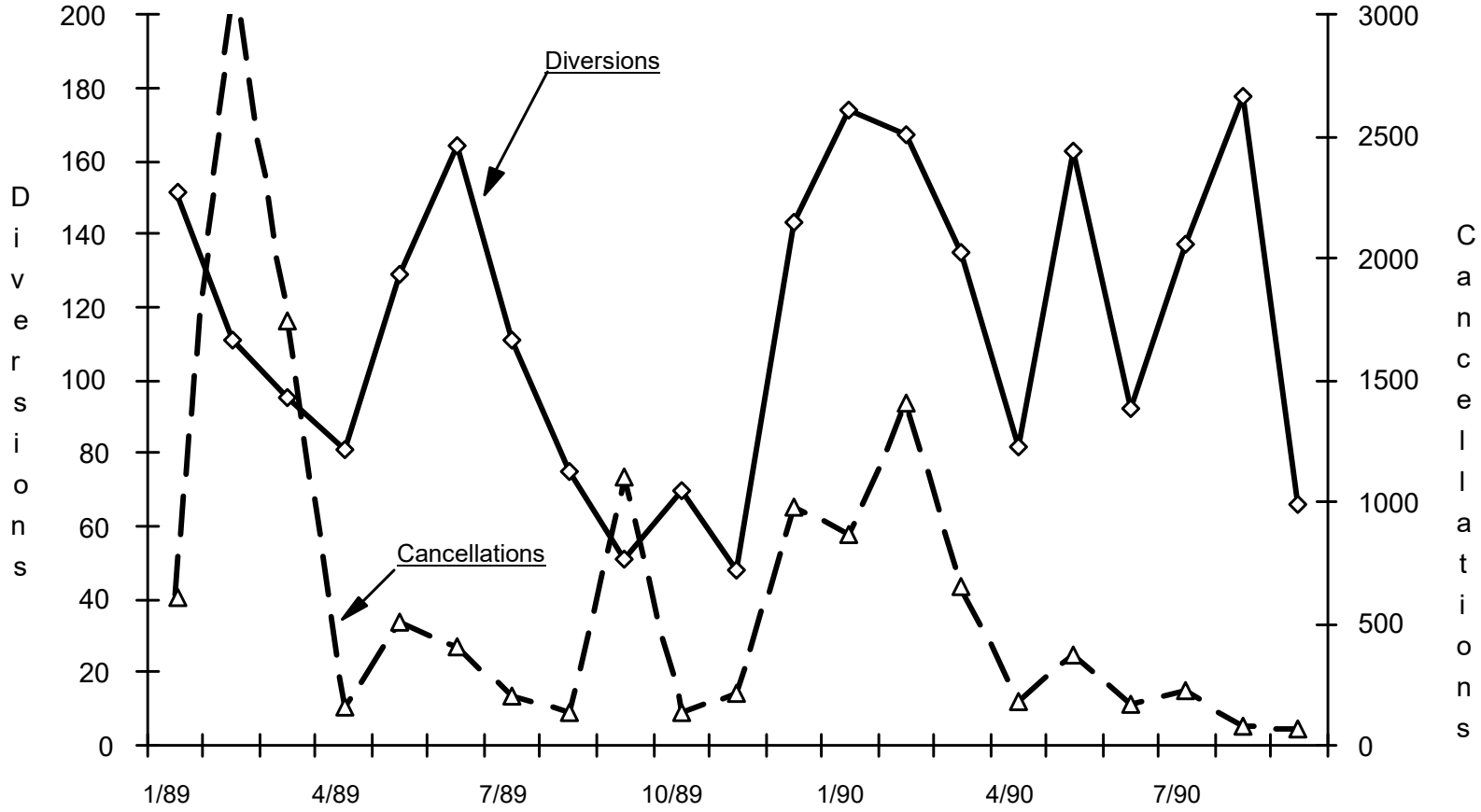

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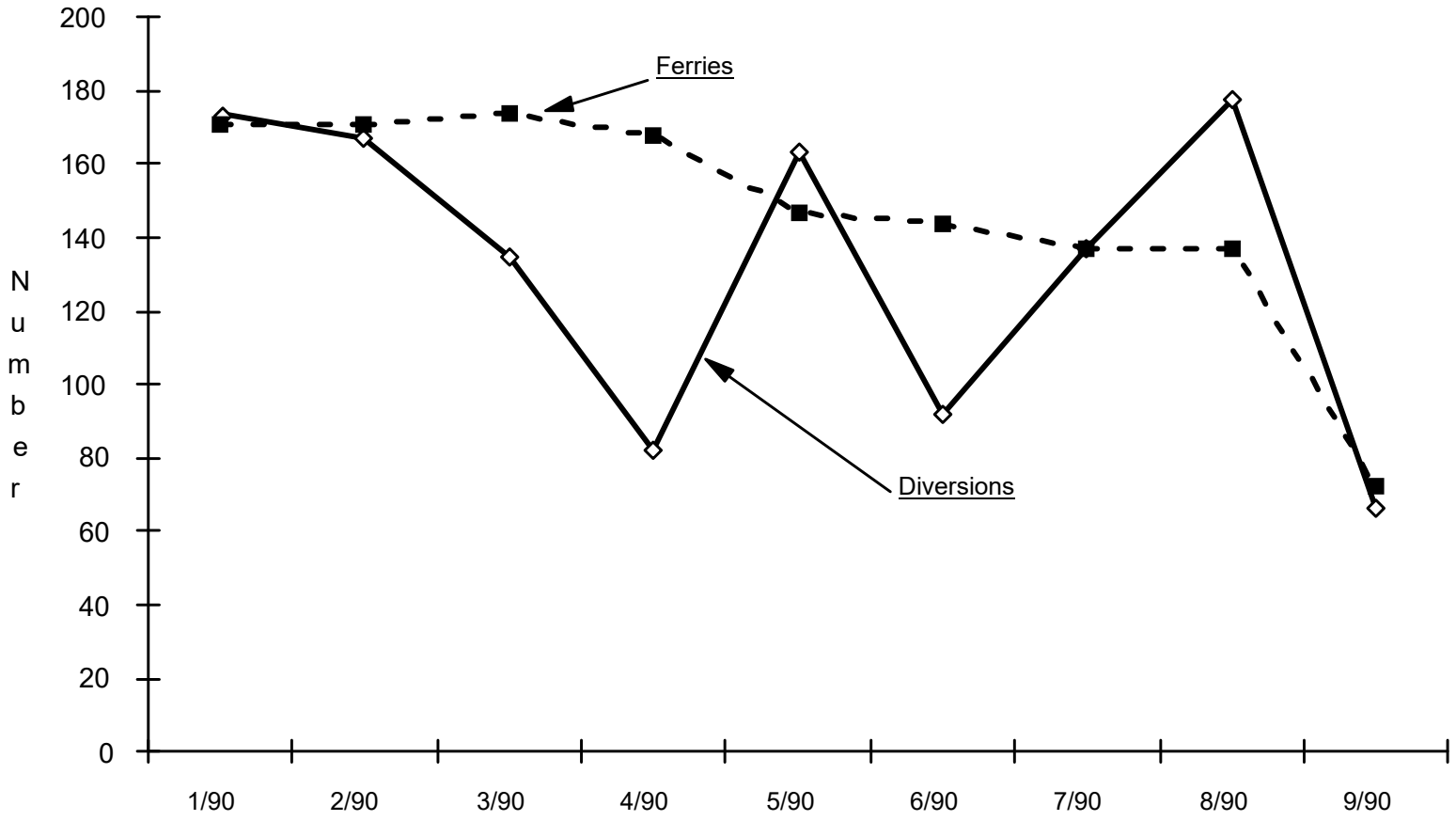

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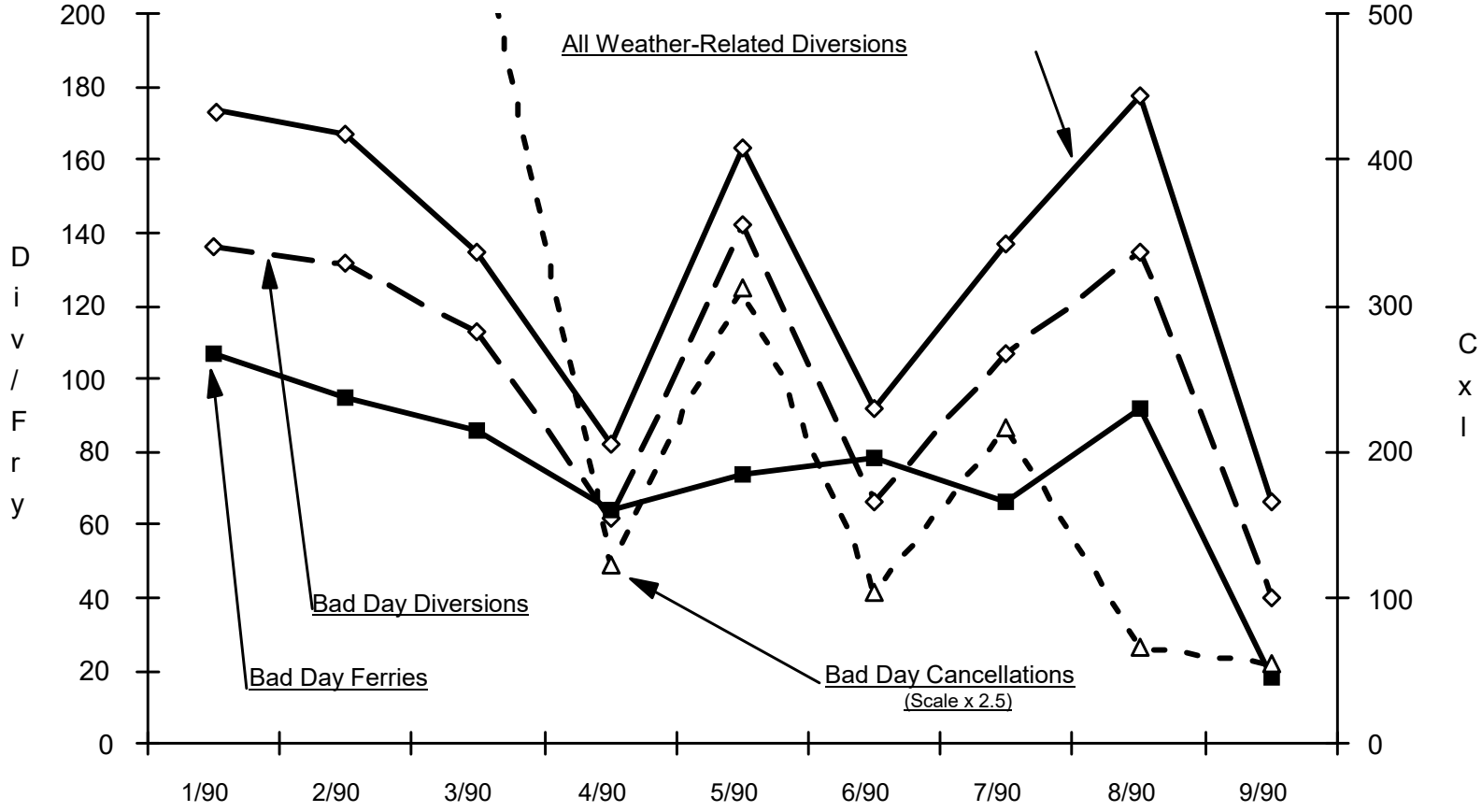

Weather-Related Diversions & Cancellations
Backup Information

Date				*Bad Div Day	*Bad Cxl Day	Mth Div Sum	Mth Cxl Sum	Mth Fry Sum	Bad Div Sum	DvCx Sum	DvFy Sum	DvFyCost Sum
1/89				5	9	152	620		124	464		
2/89				4	20	111	3165		90	2633		
3/89				2	11	95	1749		69	1532		
4/89		1989		3	3	81	159		64	93		
5/89	Total Diversions			3	6	129	505		94	430		
6/89		1239		4	7	164	404		145	398		
7/89	Total Cancellations			2	2	111	201		97	192		
8/89		9376		1	1	75	136		53	34		
9/89	Total Diversion Days			0	14	51	1102		34	387		
10/89		27	>=10/d	1	1	70	131		41	25		
11/89	Total Cancellation Days			0	2	48	211		19	93		
12/89		88	>=10/d	2	12	143	982		117	815		
1/90				5	6	174	866	171	136	805	107	$229,263
2/90				5	11	167	1410	171	132	1223	95	$248,566
3/90				3	7	135	652	174	113	572	86	$176,660
4/90		1990 (to 9/17		2	3	82	183	168	62	123	64	$181,997
5/90	Total Diversions			5	8	163	378	147	142	313	74	$219,763
6/90		1194		2	2	92	173	144	66	103	78	$238,927
7/90	Total Cancellations			3	2	137	221	137	107	217	66	$180,538
8/90		4024		5	0	178	76	137	135	66	92	$266,710
9/90	Total Diversion Days			1	1	66	65	72	40	55	18	$45,062
		31	>=10/d									
	Total Cancellation Days							Apr-Sep	Cx Fctr	Fy Fctr		
		40	>=10/d					552	1.59	0.71		
	Average Diversion Ferry Cost											
			$2,629									