# CLOSE ENCOUNTERS IN THE SKIES

## A PARADOX OF REGULATORY INCENTIVES

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BY ITS VERY NATURE, any regulation will have side effects. Some of these will be significant, some not, and some will be desirable, some not. In the case of the air-traffic control industry, which we examine here, a well-intentioned and apparently harmless statute created incentives for air-traffic controllers to fake claims of mental stress and to allow aircraft to get closer together than the Federal Aviation Administration (FAA) permits. We will show how Congress could have anticipated (and presumably avoided) both of these effects through the use of simple economic analysis.

### Incentives and Prices

A regulation is designed to alter the behavior of individuals. It does so by using some appropriate set of incentives—sanctions and rewards—to induce us to incur the costs of a behavior change. Any incentive must serve to raise the gains or lower the costs (positive incentive), or lower the gains or raise the costs (negative incentive), of the actions that the regulation is designed to affect. Which is to say that the incentive changes the *price* of the action, either explicitly or implicitly.

Now a price is a relative measure. That is, a price is a *ratio* at which two goods may be exchanged in the market. When we say that the price of a shirt is $20 (or $30), we are saying that dollars and shirts are trading at a ratio of twenty (or thirty) to one. This fact has a not-so-obvious implication: it is impossible to change just one price. Whenever we change the price of the shirt, we change it not only in terms of dollars but in terms of all the other things that dollars will buy. The failure of those who design regulatory programs to recognize this set of relationships can lead to serious consequences.

Prices do not come only in dollars or even through dollar calculations. In the late 1960s, Congress passed a regulation requiring automakers to install seat belts and other safety features in all new cars. Engineers had found —through testing with wooden dummies—that these safety features would reduce the damage

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done to a driver of a car in the event of an accident, and possibly save thousands of lives. Of course, to induce automakers to comply with the regulation, negative incentives in the form of penalties for noncompliance had to be in place.

Notice, however, that the safety features affected non-dollar prices for drivers. As cars were made safer, the price of speeding declined in terms of risk of damage: that is, speeding was cheaper. Thus, drivers could be expected to drive faster. And since none of the safety devices caused the new cars to corner better or stop more quickly, we could predict more accidents per driver-mile in new cars than in old, less "safe" cars. Moreover, because the drivers were (presumably) going faster, any given accident would be more severe. Unsurprisingly, empirical studies—particularly one by Sam Peltzman of the University of Chicago—have shown that this is precisely what happened. In short, wooden dummies could not change their driving patterns, but humans could. The regulation turned out to have unanticipated secondary effects that tended to offset its intended primary effect.

The same kind of thing happened with the U.S. air-traffic control industry. There were substantial and unanticipated changes in behavior among controllers as a result of new incentives created in 1974 when Congress altered the federal disability compensation program. While the time period covered in our study of the industry is 1973 through 1976, our conclusions have direct relevance to more recent occurrences in the industry, including (we believe) the 1981 strike. More generally, they demonstrate the scope of the problems regulators face as they try to anticipate the effects of their regulations.

## FECA and "Punching Out"

The Federal Employees Compensation Act (FECA), which has been run by the Office of Workers' Compensation Programs in the Labor Department since 1974, guarantees the income of any federal employee who is injured or disabled while serving the government. By joining the program, a worker gives up his or her right to sue the employer for on-the-job injuries in exchange for guaranteed injury compensation no matter who may have been at fault. Actual compensation varies with the severity and duration of the injury, as well as with the number of persons dependent on the income. Employees with no dependents receive 66-2/3 percent of their salary for the duration of their disability, while employees with dependents receive 75 percent. All compensation payments are tax-free and are indexed to the cost of living. They cease (or are reduced) when it is determined that the person has fully (or partially) recovered from the disability.

For the economist and indeed for any student of human behavior, these facts should immediately raise a red flag. Given income tax rates, it is entirely possible for government employees in the higher grades to be better off financially by drawing disability benefits than by working their full-time jobs. Air-traffic controllers generally advance to the higher grades quite rapidly, and typically are among the highest-paid federal employees. At 1974 salary levels, a controller with dependents who "punched out" on disability at age twenty-five after five years' experience could take home about $22,500 a year, tax-free, for the rest of his life. (Today the comparable figure would be $36,400.)

In 1974 Congress changed the FECA disability program to make it easier to qualify for compensation. Before that time, a controller (or any government employee) could qualify for compensation only after two important determinations had been made—that the injury in question was disabling and that it was also job-related. Verification of disability was usually made by an FAA flight surgeon—and occasionally by a government-designated private physician. Because the government picked the doctor, a controller could not "shop around" for one that would be sympathetic. Verification of job-relatedness required a detailed report from the employing agency outlining the supervisor's knowledge of the events leading up to the disability, prior symptoms of a medical problem, a description of the work environment before the injury, and statements from co-workers having first-hand information on the employee's condition and its cause. These procedures and rules made it relatively expensive for controllers (or other government employees) to "fake," or even exaggerate the extent of, a long-term disability in order to qualify for

compensation pay—and, for this reason, they probably deterred any significant abuse of the system.

In the 1974 FECA amendments, Congress made two highly important procedural changes in the program. For the first time, it permitted clinical psychologists to give medical evidence in a disability claim and, also for the first time, it let federal employees select a private physician (not one chosen by the government) to supply the medical testimony for their claims.

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The first change allowed government employees to claim disability without demonstrating any obvious or easily measured symptoms like broken bones, ulcers, or severed limbs. The second change had the effect of allowing the government employee to "shop around" for a sympathetic doctor, especially important in the field of psychology where the existence of an illness and its extent are hard to measure. For the economist, both changes lowered the cost to an employee of claiming a disability, especially a neuropsychiatric one, even when it did not exist. Thus it could be expected that, taken together, these changes would have a substantial impact on the behavior of air-traffic controllers.

And so they did. After the FECA amendments became effective in September 1974, controllers filed disability claims at a sharply increased rate. Their lost-time injury reports rose from 224 in 1974 to 551 in 1975 and 725 in 1976. Their occupational disease claims, which had been running at about 200 in the twelve months before the FECA amendments, rose to 453 in the next twelve months, and thereafter continued to rise. Of those 453 claims, 53 percent were for psychological or personality disorders. Comparing the two five-year periods, 1967–72 and 1972–77, neuropsychiatric claims showed an increase of 150 percent.*

It should probably be pointed out that the changing claims pattern came during a period in which the Office of Workers' Compensation Programs (OWCP) abolished its investigative staff and assigned the task of follow-up investigations to claim examiners who were already experiencing increased caseloads. This probably explains why there were no prosecutions for false filing in the five years after 1971.

We should note, too, that Congress and the FAA may have expected the increases in disability claims that followed the FECA amendments. It can reasonably be assumed that both wanted controllers who were suffering from stress to leave rather than continue to direct air traffic; and, indeed, Congress had addressed this problem in 1972 (see footnote). But it is unlikely that either Congress or the FAA anticipated that the amendments would also bring undesirable changes in controller behavior. And that, as we will show, is what they brought about.

### Claim Procedures and System Errors

To understand fully how the FECA changes affected controller behavior, it is necessary to describe the details of the disability-claiming procedure and the nature of the controllers' job. As we have said, in qualifying for disability compensation, the controller must demonstrate that a disability exists and that it is caused or greatly aggravated by the work. The doctor-shopping let the controller satisfy the first condition, but demonstrating that the problem is work-related is another matter.

Immediately after the amendments were passed, OWCP was swamped with new claims, especially claims of mental stress from air-traffic controllers. In an apparent move to process these claims fairly and quickly and to assist

*This last statistic needs to be interpreted with some care. In 1972 Congress, persuaded that controllers had a uniquely stressful job, created a special Second Career Program that provided two years full salary plus expenses for controllers who enrolled in an accredited program to train for another career. To qualify, essentially all a controller had to do was claim "too much stress on the job." We would expect that this program caused an increase in psychiatric disability claims after 1972 just as the FECA amendments did after 1974. Available evidence on claim filing patterns does not allow us to distinguish between the effects of the two programs. However, by studying other changes that occurred after 1973, we can isolate the effects attributable to just the FECA amendments.

in evaluating claims having no easily measured symptoms, the office instructed its claims examiners to look for particular incidents that were symptoms of, or contributed to, a mental disability. And in an instruction form on how to file claims under FECA for diseases due to emotional stress, OWCP drew the controllers' attention to the relevance of "specific events":

> Prepare a statement in such detail as to be complete and describe the conditions of your employment as an Air Traffic Controller Specialist which you believe caused or aggravated your disability. Include your reaction to any stressful conditions or specific events encountered in your work which you believe affected your disability. Give exact or approximate dates.

Not only was the controller encouraged to cite a particular incident that led to the stress, but his report had to be accompanied by a corroborating statement from his supervisor. The full significance of this can only be recognized after a brief description of the controllers' work environment.

The controller has essentially one duty while on the job—to maintain the required distances between aircraft in his assigned airspace. His work performance is regularly monitored by supervisory personnel who must periodically evaluate him. All the ways in which his performance is measured (how clearly he speaks when communicating with pilots, how smoothly he moves aircraft through his airspace, and so on) ultimately reduce to one: whether he maintains a safe separation between aircraft. Standard separation requirements vary according to the type of facility and the altitude of the aircraft. At an Air Route Traffic Control Center, for example, the minimum allowable separation is five miles horizontally or 2,000 feet vertically for aircraft above 29,000 feet. At many terminal facilities, the minimum separation is three miles horizontally or 1,000 feet vertically. Any violation of the standard minimums constitutes a system error.

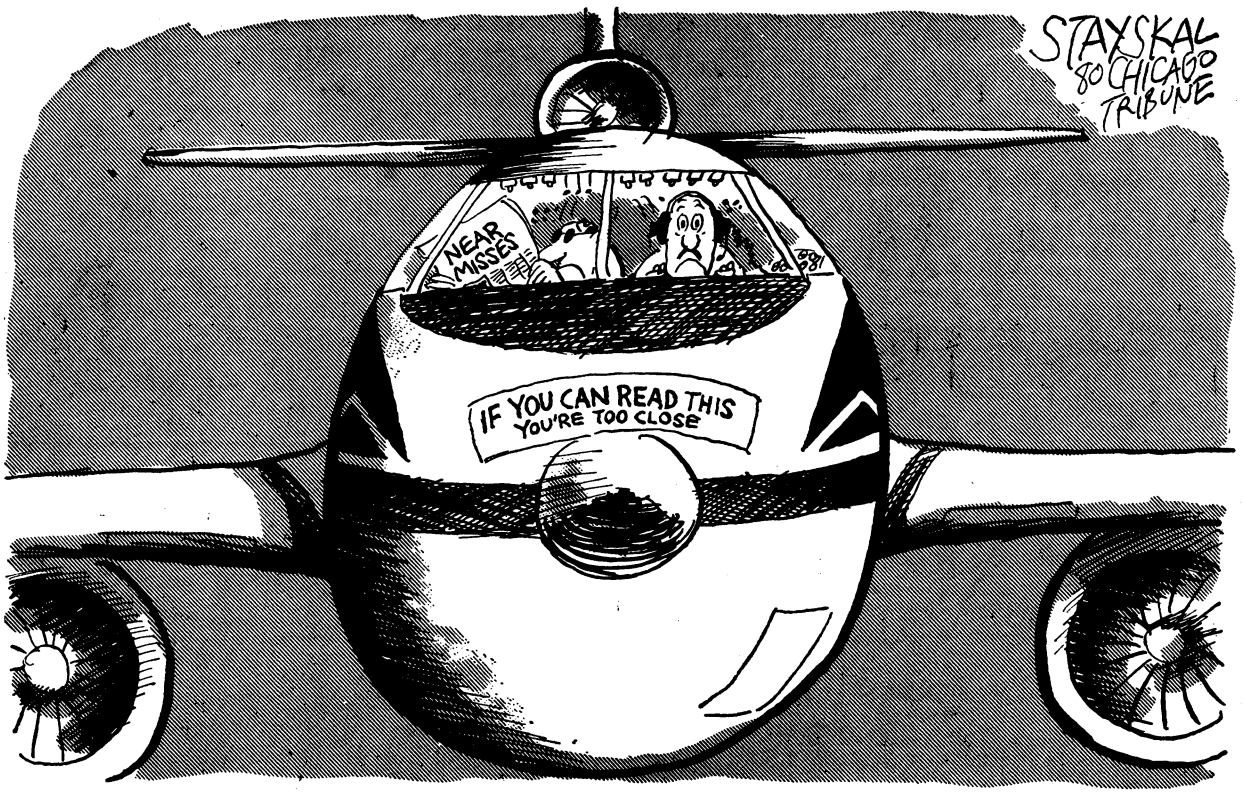
All persons involved in the air-traffic control system, including pilots, controllers, and facility supervisors, can report a system error. When an error occurs, the FAA requires that a preliminary report be phoned within hours to the Air Traffic Control Systems Command Center (in the FAA building in Washington, D.C.), and that the controllers involved be immediately relieved from duty. Then, within fifteen days, a more formal report, which provides the primary documentation on system errors, is required from a System Error Review Board. Information for each error includes the date and time of occurrence, plus a description of the facility, the aircraft types, their operations status (altitude, speed, flight phase, flight plan), and the control equipment and environment (radar types, workload, weather).

### System Errors and Near Misses

Consider the problems of a controller who is contemplating punching out on disability compensation. He would be well advised to be able to document the existence of a stressful event, and he must have his supervisor support his claim. His key task on the job is to maintain minimum separation between aircraft, and his performance in this area is carefully monitored and recorded on his personal record. Given this, a controller might calculate that his chances of a successful claim would be increased significantly if he had a system error. Thus, economic analysis of the FECA system and the 1974 changes would lead one to expect a rise in system errors after 1974.

To test this conclusion, we examined FAA records on all system errors reported for the period 1973–76. Even after adjusting for other variables that might have caused system errors to increase (total air traffic, technological changes, and new reporting procedures), we found that a significant increase had occurred in the period immediately after the passage of the FECA amendments. According to FAA data, there were roughly 280 system errors a year nationwide from 1969 through 1973 (with a bulge to 313 in 1972). In 1974 they increased to 340, about 19 percent above 1973; then in 1975 they increased 25 percent to 420, and in 1976 another 17 percent to 491. Statistically, these changes were highly significant. In other words, the congressional amendments to the Federal Employees Compensation Act, along with the way the Office of Workers' Compensation Programs handled the disability claims, had apparently induced controllers to allow airplanes to pass too close together.

Nor was this all. In addition to system errors, the FAA keeps records on another more






serious type of separation violation, the "near mid-air collision" (NMAC). These incidents are broken into three categories, based on the distance between the aircraft involved: "critical" (less than 100 feet), "potential" (less than 500 feet), and "no hazard" (collision improbable because of direction and altitude, no matter whether evasive action was taken). Anyone may report an alleged near mid-air collision (a near miss)—pilots, passengers, controllers, or individuals on the ground—but as a practical matter, nearly all such incidents are reported by flight crew members. It is almost impossible for a controller to determine from converging radar blips whether aircraft actually pass within the distances outlined in the FAA's definition of near miss. As with system errors, the FAA keeps detailed records of all reported near misses.

In his preparation to punch out, the controller's decision on how close to allow the planes to get will be affected by two considerations. First, any separation violation he reports is recorded as a system error, no matter whether someone later reports it as a near miss. Thus, there is no obvious gain to the controller from allowing the aircraft to get dangerously close. Second, if a planned system error should become an unplanned crash, people could be killed and, even if they were not, the resulting investigation could be costly to the controller. In other words, because of the added costs of a near miss and the absence of offsetting gains, we would expect to find no increase in near misses after 1974. In fact, since the controller would probably be watching his radar screen carefully during his planned system error, the error would be less likely to result in a near miss than would a "true" mistake. Thus after 1974 we would also expect to find a declining ratio of near misses to system errors.

**. . . because of the added costs of a near miss and the absence of offsetting gains, we would expect to find no increase in near misses after 1974 . . . [and] a declining ratio of near misses to system errors. And that is precisely what the data show.**

And that is precisely what the data show. After September 1974, there was no significant change in the number of near mid-air collisions. Moreover, the percent of system errors that re-

sulted in a near-miss report fell from 15.4 to 9.1 at terminals and from 12.8 to 6.1 at flight centers.

The controller's desire to keep his "planned" incident from turning into a serious accident suggests two other interesting implications. First, in deciding which aircraft to use in his system error, the controller would want to pick slower and smaller planes carrying fewer passengers. This would lower the expected cost of any accident that might occur. Second, in deciding on the time of day for his system error, the controller would want to choose a time when his assigned airspace was not crowded. This, too, would lower the expected cost of a possible accident. A careful investigation of the system error data shows that, after 1974, (1) relatively more noncommercial aircraft were involved in system errors than before, and (2) relatively more system errors occurred during the hours when traffic was low. While these results were not so statistically significant as our other findings, they strongly suggest that these two aspects of controller behavior were changing in the expected ways after the FECA amendments.

One interesting thing to note about all this is that the controllers had blamed the post-1974 increase in system errors on poor equipment maintenance and the resulting radar and computer failures, on insensitive FAA management that required long hours and heavy workloads, and thus on mental "burnout." But if these factors were the main reasons (and we are not denying that they may have contributed to some work problems), near mid-air collisions should have increased along with system errors, in the same proportions. Furthermore, we would not have observed more errors involving smaller aircraft during off-peak travel periods. This suggests that the increase in system errors may not have made air travel more dangerous. Indeed, controllers probably monitored aircraft more carefully during the times when they were executing their planned errors.

### Stress and Timing

At first glance, it would appear that the FECA amendments would have provided relief mostly for the older controllers who were suffering from burnout caused by constant stress on the job. That clearly was the intention. In addition, however, the FECA changes altered individual incentives in a way that rewarded abuse of the program by the younger controllers.

Recall again the controller who is considering punching out on disability compensation. He must decide when in his career to look for a sympathetic doctor and when to arrange his system error. From the point of view of his own pocketbook, he will want to select the timing that maximizes the value of the compensation package he will receive. This package consists of a tax-free percentage of his highest salary to date.

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Air-traffic controllers begin employment as trainees at the GS-7 level. Normal training progress allows them to advance rapidly through the grade levels so that, after their fifth year, those at larger facilities attain GS-15 status. Then GS-level advancement ceases. At 1974 federal pay rates, controllers could move from $10,500 to about $30,000 in five years, but thereafter gain only $1,000 a year. (Today the figures are $16,600, $48,600, and $1,350.) That is, after five years, the additional compensation from staying on the job one extra year is relatively small. It should thus be expected that a controller would *not* wait until he was close to normal retirement age to punch out. Instead, he would claim disability after five years, retire young, and take home more pay than he could earn by working.

And that seems to be what happened. As the table shows, in 1974, controllers with less than five years' experience (most still in training) and those with over ten years' experience (with the highest risk of genuine burnout from job stress) had the greatest incidence of system errors. In that year, controllers having five to ten years' experience represented 27 percent of all controllers but accounted for only 21 percent of the system errors. By 1976, however, this had changed. Then, the controllers in that group represented 30 percent of the total but ac-

SYSTEM ERRORS OF FAA CONTROLLERS, BY LENGTH OF SERVICE, 1974–76

| | | Under Five Years | | Five to Ten Years | | Ten Years or More | | |
|---|---|---|---|---|---|---|---|---|
| | **Controllers** | Number | % of total | Number | % of total | Number | % of total | **Total** |
| 1974 | With errors | 382 | 39 | 204 | 21 | 404 | 41 | 990 |
| | Total population | 4,039 | 20 | 5,621 | 27 | 11,068 | 53 | 20,728 |
| 1975 | With errors | 344 | 33 | 308 | 29 | 405 | 38 | 1,057 |
| | Total population | 4,164 | 20 | 5,564 | 27 | 11,087 | 53 | 20,815 |
| 1976 | With errors | 250 | 22 | 622 | 54 | 289 | 25 | 1,161 |
| | Total population | 3,597 | 17 | 6,166 | 30 | 11,125 | 53 | 20,888 |

**Notes:** Figures on reported errors include some errors in which more than one controller was involved. Percentages may not add to 100 because of rounding.

counted for 54 percent of the errors. Younger controllers were committing more of the errors.

## After 1976

Because gains and costs are relative concepts, it is impossible to alter one incentive without affecting several others. The FECA amendments created new incentives for achieving one result but in actuality produced another—a change in controller behavior in ways that most people would find most undesirable. Our formal study stopped with 1976 data, but preliminary research into the years since then suggests that the problems may be continuing or even getting worse.

For instance, in 1976 the FAA initiated a new reporting procedure in a well-intentioned move to get employees to report more safety violations. The new program in effect granted immunity from job action to anyone who reported a safety violation or "told on himself." This lowered the potential cost of reporting a violation, an incentives change that should produce more of these reports. Notice, however, that the program also lowered the cost of real and faked carelessness on the job! Before the new immunity program, a careless violation of safety rules could have led to employment termination or other job action. After immunity, the controller who was careless or violated a safety procedure could report on himself and avoid the punishment costs. It should not be surprising to learn that system errors and near mid-air collisions increased tremendously after 1976: the former rose from 491 in 1976 to 570 in 1978 and the latter from 315 to 425.

Recall the controller strike of August 1981. Controllers had been demanding early retirement benefits, better retirement pay, shorter hours, and a large salary increase. The reason they gave for these demands was the tremendous stress of their jobs. The evidence they cited to substantiate their claims of stress was the high proportion of controllers who left the job at an early age because of stress. Our study suggests that the high proportion could be interpreted in a very different way.

Finally, consider the position of the controller in 1981 who had been thinking about punching out. Suddenly it looked as though PATCO was going to call a strike. At the same time, President Reagan was telling the world that striking controllers would be fired. If this controller could qualify for disability compensation before the strike, he could avoid the personal costs of striking, avoid the risk of being fired, and end up with more pay than when he was working—all this plus regular increases for cost of living. Surely it is no coincidence that disability claims jumped sharply just before the August 1981 strike—from 76, 60 and 66 for April, May and June, respectively, to 109 in July—and that claims based on mental stress more than doubled.

WE WOULD LIKE TO STRESS that our intent here is not to criticize Congress, the air-traffic controllers, or anyone else, but rather to show that there is no such thing as a simple regulation. All regulations have complex and subtle side effects. The particular regulations affecting the air-traffic controllers offer a fruitful opportunity for examining these effects and for demonstrating their importance. ■