THE HISTORY, PURPOSE AND
SCRIPT OF COGWHEEL

R. L. Chapman
M. G. Weiner

P-1105       June 24, 1957
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Cogwheel is a 30-minute, 16 mm. sound motion picture report of one of RAND's research studies. This paper explains why it was made and what purpose it is intended to serve. Also included as an appendix is the complete script of the movie.

The Need for a Movie

RAND established the Systems Research Laboratory in 1951 to explore man's function in complex systems. (The Laboratory Staff initially consisted of John L. Kennedy, William C. Biel, Robert L. Chapman, and Allen Newell. Many other professional and technical personnel were associated with later experiments.) A specific organization in the Air Force air defense network was chosen for study—the air defense direction center. During the course of the four experiments that were conducted, some rather challenging practical and theoretical implications began to emerge.

As a consequence, the Laboratory Staff was called on to describe the experimental conditions, and to report the results that were obtained, to a variety of people—to officers of the Air Defense Command, to research personnel concerned with air defense analysis, and to scientists interested in human behavior. While some aspects of the experiments, such as the load variables and performance results, could be easily explained to even such a mixed audience, it was clear that the phenomenon being examined was complex and that the experimental procedures were both new and involved. John L. Kennedy, head of the Laboratory Staff,
suggested, prior to the fourth experiment, that an attempt be made to provide the needed context with a movie made about the Cogwheel crew.

The Movie's History

M. G. Weiner and R. L. Chapman undertook the job. They reviewed incidents involving crews of previous experiments and the many activities of the experimenters and prepared a script. Graphic Films was employed to produce the film. The shooting was done in four days following the Cogwheel experiment proper in early July, 1954. (Hawley Blanchard and Hubert Stark of the Laboratory Staff were responsible for many arrangements during this phase.)

Completion of the film was delayed for almost a year. Additional shots were obtained, and the film was edited and narrated. (John O'Connell participated in this portion of the preparation.)

An extensive preview of this particular version of Cogwheel was done. It was shown to several hundred audiences as part of informal and formal presentations about SRL research.

During this period, the System Development Division of The RAND Corporation was established to implement some of the immediate and practical results of the research; it produced its own films to communicate with the military audience.

Also, as analysis of the data proceeded, it was apparent that there were many theoretical implications of the research and that the framework for interpreting these results would
continue to change as better understanding of the phenomenon was attained. Further, different aspects of the research appealed to different audiences: Some persons were intrigued by the experimental methods and by the simulation techniques; others were interested in substance—air defense effectiveness, the design and management of military systems, organization theory, interpersonal relations, or just human behavior.

While the experiments and the data did not provide answers to all of these questions, or for that matter to any of them, the research did suggest scientific concepts, provide interesting evidence, and demonstrate the usefulness of a new methodology. But even the very powerful medium of the sound motion picture could not satisfy so many interests simultaneously.

The film was revised, however, in an attempt to redirect it somewhat, to pace it more appropriately, and to remove some of its more obvious defects. R. L. Chapman tried to resolve these many anomalies by preparing a new script; the film was then re-edited and narrated to obtain the final product. M. G. Weiner, William Allen, John Tyo, John Kennedy, John O'Connell, and Brownlee Haydon aided in this effort. (H.F.W. Perk and Donna Bengtson also assisted.) Melvin Sloan of Film Workshops, Inc., not only supervised the technical editing and production but contributed immeasurably to whatever excellence it represents.

The Purpose of the Film

A dominant result of the SRL studies is obviously the work being carried on by RAND's System Development Division. It is
conducting a system training program for the Air Defense Command of the Air Force. In terms of impact on general welfare--improved defense against enemy attack--and in amount of talent and progress in exploiting some scientific findings, this single, practical application overwhelms all others.

Cogwheel does not try to tell that story--much of it is still classified, much of it is being told in other places by SDD, and many of the lab findings have been modified in the translation to the exigencies of real life.

Nor does it state the hypotheses, the experimental design, or explicit findings. (The description of the experimental variables, of construction of the stimulus, and other experimental conditions plus observations and data occupies almost sixty file drawers. The analysis that has been done and the theory that is beginning to emerge is still tentative, and any simple summary of it would be misleading.)

The film is, however, a general introduction to one approach to the experimental study of organizations; it provides the viewer with a notion of the complexity of conducting such large-scale experiments and of the "realism" of the behavior elicited, and with a narrative rather than scientific description of organizational development. As such, it stands on its own.

For viewers that have particular interests it furnishes a meaningful background for any additional information that they may need. The bibliography lists the publications that are available.
Appendix I
COGWHEEL SCRIPT

MUSIC

OPEN FADE IN:

(PICTURE OF RAND BUILDING ONLY)

(PICTURE OF RAND BUILDING WITH THE FOLLOWING SUPERIMPOSED. USE LARGE AND SMALL ITALICS.)

The RAND Corporation (LARGE ITALICS)

...a nonprofit corporation...formed...to further and promote scientific, educational, and charitable purposes, all for the public welfare and security of the United States of America. (SMALL ITALICS)

(FADE ALL PRINTING BUT THE RAND CORPORATION AND SUPERIMPOSE THE FOLLOWING PRESENTATION SENTENCE.)

Presents (CENTERED)

A Report of One of Its Research Studies

DISSOLVE TO: (MOVEMENT BOARD WITH "COGWHEEL" SUPERIMPOSED)

(MUSIC OUT)

NARRATOR: This is the story of Cogwheel. Cogwheel is just a name--but it means air defense. Cogwheel is an air defense station--the radar and the men and the interceptors. It stands between us and enemy bombers; it protects our cities, our homes, our families.

DISSOLVE TO: (ONLY COGWHEEL SUPERIMPOSE)

DISSOLVE TO: (CLOSEUP OF EARLY-WARNING STATION)
TELLER: Hello, Cogwheel. I have a move on track 11, to Queen Dog 1241. The time is 20.

NARRATOR: (LOW VOICE) This is a teller. He's watching a radar scope and relaying the information to a plotter.

(BACKGROUND CROSS TALK)

TELLER: Move on Track 8 to Mike Easy. Mike Easy 1525. The time is 20. I have an initial in Mike Fox. Mike Fox 0035.

CUT TO: (HAND PLOTTING A TRACK ON THE CENTRAL PLOTTING BOARD /HEREAFTER REFERRED TO AS CPB/)

TELLER: The time is 20 on the initial.

NARRATOR: The information from the teller is plotted on a central display.

CUT BACK TO: (EARLY-WARNING STATION)

TELLER: I have a move on track 4 to Queen Fox. Queen Fox 2249. The time is 20. I have a move on track 11 to Queen Dog 2038. The time is 21. I have a move on the initial in Mike Fox to Mike Fox 4030. The time is 21.

CUT TO: (CPB WITH ARM PLOTTING 20)

TELLER: This initial is estimated at 10 angels--160 speed.

(PLOTTING BOARD BACKGROUND NOISE)

I have a move on track 4 to Queen Fox. Queen Fox 2040. The time is 21.

CUT TO: (MOVEMENTS IDENTIFICATION SECTION SHOWING CHECKING OF FLIGHT PLANS)
MOVEMENTS IDEN.
OFFICER: What about Charlie 13?

TECHNICIAN: Where's it at, sir?

MI OFFICER: King Easy.

NARRATOR: The man on the right is the officer in charge of identifying aircraft in the area.

MI OFFICER: Do we have any flight plans that come close to that?

TECHNICIAN: No possibilities, sir.

MI OFFICER: (PICKING UP PHONE)

Height tote? Charlie 13 ... UNKNOWN. Roger.

CUT TO: (HEIGHT TOTE BOARD)

NARRATOR: Charlie 13 is changed to UNKNOWN on the central display.

CUT TO: (SENIOR DIRECTOR ON PHONE)


NARRATOR: The Senior Director is ordering fighters out to investigate the Unknown.

SENIOR DIR: Angels 15, Channel 1 ... Rog.

(SENIOR DIRECTOR TURNS TO DIRECTOR)


(SENIOR DIRECTOR TURNS BACK TO VIEWING CPB. HE THEN TURNS TO TECHNICIAN ON LEFT)

Notify Kingpin we scrambled Redbird Red after Charlie 13.
TECHNICIAN: Roger.

(PICKS UP PHONE)

Kingpin, this is Cogwheel. We have just scrambled Redbird Red on Charlie 13.

CUT TO: (CPB)

TECH (CONT.): Roger.

CUT TO: (CLOSEUP OF DIRECTOR ON PHONE)

PILOT'S VOICE: (OVER PHONE)

Cogwheel Control, this is Redbird Red, airborne at time 23, climbing to 15 Angels. ETA at check point 205 is 31. Over.

DIRECTOR 1: Redbird Red, this is Cogwheel. Roger. Understand, check point 205, vector check point 164 for Bogie. Over.

PILOT'S VOICE: (PHONE) Redbird Red, vector check point 164. ETA will be 39. Roger. Out.

CUT TO: (CPB)

CUT BACK TO: (CLOSEUP OF DIRECTOR)

DIRECTOR 1: Redbird Red, your Bogie twelve o'clock, sixty miles. Over.

CUT TO: (CPB)

PILOT'S VOICE: (PHONE) Redbird Red, Rog.

CUT TO: (SENIOR DIRECTOR)

CUT BACK TO: (CPB)

NARRATOR: All eyes are focused on the central display. The fighters—Redbird Red—are closing in on the Unknown, Charlie 13.
CUT TO:  (LONG SHOT OF SENIOR DIRECTOR AND OTHER DIRECTORS)

DIRECTOR 1: Redbird Red, Bogie, 12 o'clock, 11 miles. Over.
(PAUSE WHILE LISTENING TO PILOT)
Roger, Redbird Red. Understand, investigate
Bogie ... TALLYHO ON 13.

NARRATOR: Tallyho means that the fighters have made contact
with the Unknown. "Investigate Bogie" is the
order to approach closer so that the aircraft
type and serial number can be seen.

MI OFFICER:  (APPROACHES THE SENIOR DIRECTOR WITH PAPER)
Sir, we have a late flight plan here. It's
United Airlines Dog Charlie 6 NAN 4532. May be
this Charlie 13, up here, sir.

SENIOR DIR: Charlie 13, OK, I'll inform the Director.
(SENIOR DIRECTOR TURNS TO DIRECTOR 1)

DIRECTOR 1: Redbird Red, Bogie is Dog Charlie 6 NAN 4532 ...

SENIOR DIR: (TO DIRECTOR)
4532 is friendly--Charlie 13. Skip it.

DIRECTOR 1: (ON PHONE)
Roger. Redbird Red, skip it.

CUT TO:  (TOP DECK VIEW OF STATION)

NARRATOR: Cogwheel seems like a real air defense station.
(LIGHTS UP ON TOP DECK VIEW)
But it's not.

(MUSIC)
It's in a laboratory--the Systems Research Lab-
oration of The RAND Corporation. This is, in
NARRATOR (CONT.): fact, an experiment—one designed to study air defense organizations, what air defense operating problems are, how they can be solved.

PAN TO: (MEN CLIMBING DOWN FROM CPB PLATFORM)

CUT TO: (SHOT FROM FRONT OF STATION WITH PAN UP TO TOP DECK)

NARRATOR: Here the experimental staff watches what the crew does and says, how it performs in specific situations.

CUT TO: (CLOSEUP OF EXPERIMENTERS)

NARRATOR: Earlier the experimenters designed a variety of possible attacks under different realistic traffic conditions.

CUT TO: (CLOSEUP INSERT OF SPECIFICATIONS) (UNCLASSIFIED)

NARRATOR: From these problem specifications, the complex information inputs to the crew were built using electronic computers.

CUT TO: (CONTROL ROOM WITH PAN TO AUDOGRAPHS)

NARRATOR: All of the crew's telephone and face-to-face conversations are recorded.

CUT TO: (CLOSEUP OF KEYPUNCH)

NARRATOR: By means of special keyboards, these staff members code the crew's telephone reports onto punched cards.

CUT TO: (CLOSEUP OF CORRELATION MAP SHOT)

NARRATOR: They compare the crew's actions with the air situation that was presented.
CUT TO: (SORTER OPERATION)

NARRATOR: The crew actions coded onto punched cards are summarized and checked ...

CUT TO: (THREE EXPERIMENTERS)

NARRATOR: ... taking into account the observations made by those watching the crew. This data is used to prepare a detailed report of the results of each day's operation—how many bombers got through, how many were stopped.

CUT TO: (MEN ENTERING DEBRIEFING ROOM -- LONG SHOT)

NARRATOR: Here in the laboratory the crew gets together to go over the report of its performance. This is part of the plan to ...

CUT TO: (IBM TABULATOR)

NARRATOR: ... speed up the crew's learning so it can solve its own problems. The experimenters know that both practice and knowledge of results are necessary for learning. So the crew is told how well it has done. The machine-prepared summary of the day's performance is, therefore, ...

CUT TO: (MI OFFICER AND TECHNICIAN)

NARRATOR: ... presented to the Senior Director ...

CUT TO: (SENIOR DIRECTOR -- REPORT IS DELIVERED TO HIM BY WEINER)

NARRATOR: ... while the operation is still fresh in everyone's mind.
CUT TO: (DEBRIEFING WITH SENIOR DIRECTOR READING FROM REPORT -- FULL SHOT)
(MUSIC OUT)

SENIOR DIR: This is the first of the training reports that we will be receiving each day after operations. The summary says we had six critical tracks today. These other sheets each refer to one track. They are divided into two sections--the first part gives the facts on the track, and the second part indicates what action the crew took. Now, here's Charlie 13 Dog. It was a DC6, United Airline. Number is NAN 4532.

CUT TO: (CLOSEUP OF MI OFFICER AND TECHNICIAN)

SENIOR DIR: (IN BACKGROUND) It first appeared in the system at time 20. It was on the plotting board immediately and identified Unknown ...

CUT BACK TO: (CLOSEUP OF SENIOR DIRECTOR)

SENIOR DIR: ... at 21.
Redbird Red was scrambled, and the flight plan was furnished just before the interception was made on this one. That seems pretty good.
The second one is Charlie 32 George. This is the intercept we missed. This was a Pan American Clipper NAN 9820. It was ... it originated in
SENIOR DIR. (CONT.):
Gadfly's area at time 39 and got on the plotting board at 53. That's a fourteen-minute delay.
How come, Gadfly?

CUT TO:
(CLOSEUP OF GADFLY SUPERVISOR AND DIRECTOR 1)

GADFLY SUP:
Well, sir, we had some trouble. Our scope coverage doesn't correspond with the plotting board, and I'd say it took us about fifteen minutes to get it up.

(CAMERA PANS TO CLOSEUP OF SENIOR DIRECTOR)

SENIOR DIR:
I see. The aircraft's actual altitude was 20,000 feet, and you people were reporting it at ten.

CUT TO:
(CLOSEUP OF DIRECTOR 1)

DIRECTOR 1:
That's why I missed it! We had our fighters right out there--right on the nose--and nothing happened! By the time we made our second pass, the thing was already going in for a landing.

CUT TO:
(CLOSEUP OF SENIOR DIRECTOR)

CUT TO:
(CLOSEUP OF GADFLY SUPERVISOR AND DIRECTOR 1)

GADFLY SUP:
Major, if we had of plotted it right away, the altitude would have been correct. But when we waited, we had it too far in on the calibration chart; and that's why the angels were wrong.

DIRECTOR 1:
(TURNS TO GADFLY SUPERVISOR)
You made us miss the intercept!

GADFLY SUP:
Well, maybe next time we could call the information in before to the Air Surveillance Officer.
CUT TO: (CLOSEUP OF SENIOR DIRECTOR, AS AND MI OFFICERS)

SENIOR DIR: That would cut down the time delay.

AS OFFICER: Yes, sir, I feel that would reduce the time delay. If we advise MI as soon as we learn of these tracks, you would still have time to get fighters ...

CUT TO: (CLOSEUP OF GADFLY SUPERVISOR AND DIRECTOR 1)

AS OFFICER: ... out there before it's too late!

CUT TO: (CLOSEUP OF SENIOR DIRECTOR, AS AND MI OFFICERS)

MI OFFICER: Yes, I believe that would work fine, Captain. As soon as you called us, we could check our flight plans to see whether it was friendly or unknown; and then I could call you right away, Major.

SENIOR DIR: OK, we'll adopt that procedure.

NARRATOR: This is the Cogwheel crew's first day in the laboratory. As these men face tougher and tougher situations, they will learn the teamwork necessary for more effective defense against air attacks.

CUT TO: (CLOSEUP OF MEN REPORTING IN FOR DUTY. OFFICER SITS AT DESK WITH BACK TO CAMERA. BACKGROUND CONVERSATION BETWEEN CREW MEMBERS AND ADMINISTRATIVE OFFICER)

NARRATOR: Only a short while ago these men were strangers, working in different air defense stations all over the country. They were brought here to the laboratory so that the research staff could
NARRATOR (CONT.): find out how crews like this one can learn to operate more effectively. The experimenter's main interest is in understanding organizations so that many activities--not only air defense--can be improved.

So Cogwheel is more than just an air defense story. It is the story of how organizations develop.

ADMIN. OFF: You want to go into the next room now and have a seat?

CUT TO: (FULL SHOT OF MEN ENTERING AUDITORIUM AND TAKING SEATS. CAMERA PANS TO SIDE VIEW OF CHAPMAN.)

NARRATOR: A part of the story is to get the crew to understand the experimental conditions by putting the task and the rules in air defense terms.

CHAPMAN: Today you begin a tour of duty here at The RAND Corporation in Santa Monica. You have been wondering, no doubt, since you got your orders, what this is all about.

CUT TO: (CLOSEUP OF CHAPMAN)

CHAPMAN: Well, you're here to work on an air defense project.

CUT TO: (VIEW OF AUDIENCE)

CHAPMAN: You will man the air defense station that is set up in this laboratory ...
CHAPMAN: Your job will be to defend your area of responsibility.

CUT TO: (FULL SHOT OF CHAPMAN INCLUDING PART OF AUDIENCE)

CHAPMAN: But, why, with all the planning and research that has been done, why aren't you told precisely how to operate? What is the best way to defend the area?

CUT TO: (CLOSEUP OF CHAPMAN)

CHAPMAN: I suppose it can best be said this way.

CUT TO: (SIDE VIEW OF AUDIENCE)

CHAPMAN: No matter how many scientists and planners get together to build an air defense system, it takes crews to run it.

CUT TO: (SIDE VIEW OF AUDIENCE)

CHAPMAN: There's a difference between what the equipment is supposed to do, how well the operating procedures are supposed to work—and how it all proves out when the chips are down.

CUT TO: (CLOSEUP OF CHAPMAN)

CHAPMAN: People working together make a crew that gets the job done.

CUT TO: (SIDE VIEW OF AUDIENCE)

CHAPMAN: But have you been brought here to defend against the everyday air situations that you know so well? No, you have not.

(PAUSE)

You know the world situation is tense.
CUT TO: (SIDE VIEW OF CHAPMAN)

CHAPMAN: Tomorrow, it could be hostiles that you're tracking. And a plane that gets through could mean an A-bomb over one of your cities.

CUT TO: (VIEW OF AUDIENCE)

CHAPMAN: The strike will come. But when? Where? And, how many?

CUT TO: (CLOSEUP OF CHAPMAN)

CHAPMAN: Will they come high and fast, or just off the deck? Will it be a mass raid or single aircraft in with the flight plan traffic? Can you stop them?

CUT TO: (CLOSEUP OF CHAPMAN)

CHAPMAN: The enemy will make his move ...

CUT TO: (SIDE VIEW OF CHAPMAN)

CHAPMAN: ... perhaps tomorrow. Not just a single strike. But, for the rest of your stay here, they'll keep coming.

CUT TO: (SIDE VIEW OF CHAPMAN)

(CHAPMAN MOVES TO SIDE OF LECTERN)

CHAPMAN: This is the way that it will be. And the question that remains to be answered is--can you stop them?

(CAMERA PANS TO SENIOR DIRECTOR RISING FROM SEAT IN FRONT OF AUDIENCE)

SENIOR DIR: All right, men. Now we know our job. We've got ...

(BACKGROUND DISCUSSION AMONG MEN)

NARRATOR: That's how the first day started--that's how the experiment began.
DISSOLVE TO: (EARLY-WARNING STATION)

NARRATOR: The early-warning stations are the distant eyes of air defense. Many miles apart in real life ...

CAMERA PANS ALONG THREE STATIONS: ... here in the laboratory they are side by side. But in both places the job ...

CUT TO: (CPB)

NARRATOR: ... is the same ... to follow all of the aircraft their radar can see.

The Air Surveillance Officer sits in front of the central display board in the main station.

CUT TO: (LONG SHOT OF STATION CENTERED ON AIR SURVEILLANCE AND MOVEMENTS IDENTIFICATION SECTIONS)

NARRATOR: He keeps close watch on the picture of the air situation as it develops and makes sure that nothing goes unnoticed.

CUT TO: (CLOSEUP OF MI OFFICER)

NARRATOR: Behind the Air Surveillance Officer is the Movements Identification Officer.

CUT TO: (LONG SHOT OF AS AND MI SECTIONS)

NARRATOR: He sorts the unknown planes from the friendlies.

(MI OFFICER WATCHES BOARD AND INDICATES TRACK TO TECHNICIAN. FAINT BACKGROUND CONVERSATION IS HEARD.)

MI OFFICER: Do we have a flight plan on this one?

TECHNICIAN: No, friendly, by area.

NARRATOR: Friendly planes scheduled to be in Cogwheel's area
NARRATOR (CONT.): have filed flight plans with the Civil Aeronautics Authority. These flight plans come to Cogwheel. Here they are compared with the radar tracks to identify the friendly planes.

MI OFFICER: (PICKS UP PHONE)
Charlie 18, Friendly.

CUT TO: (CLOSEUP OF SENIOR DIRECTOR)
NARRATOR: The Senior Director is the man who makes the decisions—when to send the fighters up and whether the fighters ...

CUT TO: (FULL SHOT OF MAIN SECTION -- SIDE VIEW)
NARRATOR: ... should open fire. Behind the Senior Director are the two Directors. They talk to the fighter pilots by radio ...

CUT TO: (CLOSEUP OF DIRECTOR 1 ON PHONE)
NARRATOR ... telling them where to fly to meet the Unknowns.

CUT TO: (FULL SHOT OF AS SECTION)
NARRATOR: These are the men who have to work together to get the job done.

CUT TO: (EARLY-WARNING STATION)
TELLER: This looks like a mass raid coming in in Jig Baker here.
(PAUSE)
Estimated eight aircraft. Angels 20 ...
Put the lead aircraft Jig Baker 2530 ...
Other point, Jig Baker 0535.
CUT TO: (CPB SHOT WITH MASS RAID BEING PLOTTED)

MI OFFICER: What do we have on this Charlie 20?
TECHNICIAN: Where's it at, sir?
MI OFFICER: In Able Baker.
TECHNICIAN: Nothing in Able Baker, sir.
MI OFFICER: Height Tote, Charlie 20 ... UNKNOWN.
CUT TO: (FULL SHOT OF MI SECTION)
(AS OFFICER TURNS TO TALK TO THE MI OFFICER)
AS OFFICER: You got that mass raid down south. Do you see it?
MI OFFICER: (TURNS TO TECHNICIAN)
Roger. Do we have anything ...
CUT TO: (CPB SHOT)
MI OFFICER: ... in Jig Baker? Charlie 21?
TECHNICIAN: Nothing in Jig Baker.
CUT BACK TO: (FULL SHOT OF MI SECTION)
AS OFFICER: As of now it's five aircraft.
MI OFFICER: (TO TECHNICIAN)
Five aircraft. We have no flight plans?
TECHNICIAN: Negative. No flight plans.
MI OFFICER: (PICKS UP PHONE)
Height Tote, Charlie 21 ... UNKNOWN also.
CUT TO: (CLOSEUP OF SENIOR DIRECTOR ON PHONE)
SENIOR DIR: Redbird Ops, this is Cogwheel. Scramble Redbird White, Blue, and Green.
CUT TO: (CPB SHOT -- CONFUSED PLOTTING SEQUENCE)
SENIOR DIR: Vector check point 265. Take Angels 20, Channel 1, going after track Charlie 21. Also, scramble Blackjack Red, White, and Blue. Vector check point 265.

CUT BACK TO: (SENIOR DIRECTOR)

SENIOR DIR: Take Angels 25 on Channel 2 ... Charlie 21.

(AS OFFICER ENTERS SCENE)

AS OFFICER: (POINTING TO CPB)

Sir, that track 25 is still unidentified.

SENIOR DIR: Hello, Ops ... I got another one for you. Scramble Blackjack Green. Vector check point 217. Take Angels 20, Channel 2. This is after track Charlie 25.

(PAUSE) Roger, Ops ... out.

(CAMERA PANS FROM SENIOR DIRECTOR, THROUGH AS OFFICER TO MI OFFICER)

AS OFFICER: Will you clear everything in southwest quadrant that is friendly?

CUT TO: (CPB SHOT. HAND ERASES PLOTS. ANOTHER HAND CONTINUES PLOTTING ON MASS RAID.)

NARRATOR: The job is harder now, and the crew tries to find out what its mistakes were and what to do about them.

DISSOLVE TO: (CLOSEUP OF SENIOR DIRECTOR)

CUT TO: (FULL SHOT OF DEBRIEFING)

SENIOR DIR: I don't know if we are saturated now or not. The board ...
CUT TO: (CLOSEUP OF SENIOR DIRECTOR)

SENIOR DIR: ... got pretty confused at times.

CUT BACK TO: (DEBRIEFING)

DRAGNET SUP: The traffic up there was terrific today. I don't believe I've ever seen that many tracks in one spot. I thought we had 'em all, though.

SENIOR DIR: I know you men have been working hard and that board gets rather confused at times.

CUT TO: (CLOSEUP OF SENIOR DIRECTOR THUMBING SHEETS)

SENIOR DIR: But, according to these sheets, a couple of tracks went quite a way through our area before we detected them. And one track went all the way through, and we never did get it on the board.

CUT BACK TO: (DEBRIEFING)

MI TECH 2: We had a number of flight plans that didn't co-ordinate with anything on the board.

AS OFFICER: Well, sir, there may have been some more, but I just don't know what we could've done about it at all.

COGWHEEL SUP: I noticed that the traffic seems to pile up on the board. When Dragnet was so busy, Flattop didn't have hardly any traffic at all. I don't know ... it seems to me that if the traffic load was spread out more, it would be a lot easier to handle.

DRAGNET SUP: And it gets worse when you get a mass raid. We were callin' 'em in as fast as we could.
COGWHEEL SUP: The traffic wasn't movin' too fast. Sometimes it took us as much as four or five minutes to get a move on a track.

MI TECHNICIAN: You know, it's almost impossible to correlate tracks if the plots aren't kept up-to-date.

AS OFFICER: The question is, is it possible for those plotters to handle this much traffic? We had some of our best men on the plotting positions when that Goonybird came through.

CREW MEMBER 1: I'll tell you one thing. It's not just the plotters when the traffic gets heavy. It helps to have a good teller on the line, so that you can get more plots up there.

CREW MEMBER 2: That's right! The way some of them tellers call in the information you can't even put it up there.

CREW MEMBER 1: It wasn't so bad today. But a couple of days ago I had some guy on the line. We had three tracks. They were movin' right along one after another. He'd give me a move on the middle one, and I'd move it up on the front one. It just messes up the whole board.

CREW MEMBER 2: When the teller jumps around the board, you have to put up a new plot right where an old one is.

CREW MEMBER 1: After all, the teller's job is to help the plotter as much as he can. If he just moves that front one on up, you could get those arrows out of there and clear the board up a lot.
CREW MEMBER 2: Otherwise, you have a big mess ... and you get pretty confused.

AS OFFICER: Well, sir, this would cut down the time to get that information on the board for you. However, a lot of our plotters haven't had much experience with this much traffic, and it's also going to put a load on the supervisor in selecting his men at time of crew change.

DRAGNET SUP: Did somebody say that Flattop wasn't loaded when that raid came in?

FLATTOP SUP: What time was that?

DIRECTOR 2: That raid appeared approximately thirty minutes after we started operations.

FLATTOP SUP: Well, we didn't have much until about the last hour or so.

DRAGNET SUP: (TURNS TO FLATTOP SUPERVISOR)
Our coverage overlaps yours over that airlane, doesn't it?

FLATTOP SUP: Yeh, I think so.

DRAGNET SUP: Were you painting any of those tracks that we were?

FLATTOP SUP: For a part of the time, at least.

COGWHEEL SUP: Could Flattop have handled them, then?

DRAGNET SUP: That was what I was thinking.

FLATTOP SUP: Well, we could if we knew what they were and where they were.
DRAGNET SUP: I could sure dump some on you if I knew.

SENIOR DIR: Maybe we aren't saturated after all.

CUT TO: (FULL SHOT WITH SENIOR DIRECTOR WITH BACK TO CAMERA)

SENIOR DIR: Using these new procedures, we may be able to get through tomorrow's operations. You know they keep boosting our traffic load up on us each day.

CUT TO: (CLOSEUP OF SENIOR DIRECTOR -- FRONT VIEW)

SENIOR DIR: The summary says there were four in that mass raid that bombed us, and the single aircraft got through. I guess that's the worst day we have had so far.

CUT TO: (LONG SHOT OF DEBRIEFING WITH SENIOR DIRECTOR WITH BACK TO CAMERA)

SENIOR DIR: But I'm sure we'll do better tomorrow. Does anybody have any further suggestions? Captain? OK, that's all for today. See you at 0800 tomorrow.

(CREW RISES TO LEAVE DEBRIEFING)

NARRATOR: Day by day, the operations in the laboratory and the discussions that follow combine to help crew members learn the need for cooperation. For example ...

DISSOLVE TO: (TOP DECK SHOWING LIGHTS OVER EXPERIMENTAL AREA)

NARRATOR: ... plotters learn to cooperate with tellers ...
NARRATOR (CONT.): early-warning stations learn to work together in balancing the system's load.

CUT TO: (AIR DEFENSE DIRECTION CENTER FROM ABOVE -- CAMERA PANS TO REAR VIEW OF DIRECTOR 1 AND TECHNICIAN)

DIRECTOR 1: (ON PHONE)
Roger, White Leader. Understand.

CUT TO: (SIDE VIEW OF MI OFFICER, DIRECTOR 1 AND TECHNICIAN)

DIRECTOR 1: Redbird White ... when you reach check point 304, split into two flights of two aircraft each. Over.

CUT TO: (FULL SHOT OF SENIOR DIRECTOR PICKING UP PHONE)

DIRECTOR 1: Redbird White, the second flight will be Redbird Blue. Over.

SENIOR DIR: (ON PHONE)
Hello, Kingpin. Let me talk to the Senior Controller.

NARRATOR: The Senior Director keeps his superiors informed of developments.

SENIOR DIR: This is Cogwheel ...

CUT TO: (CPB SHOT SHOWING DEVELOPMENT OF TACTICAL SITUATION)

SENIOR DIR: ... We've got four unknown tracks. Do you have any activity in the other sectors? OK, we got a lot of business here right now ... Roger.

CUT TO: (CLOSEUP OF DIRECTOR 1 AND TECHNICIAN)

DIRECTOR 1: (ON PHONE) OK, Roger, Blue. Understand ...
CUT BACK TO: (CPB SHOT)

DIRECTOR 1: ... Your Bogie now 12 o'clock. Over. Roger, Blue, investigate Bogie.

CUT TO: (FULL SHOT WITH SENIOR DIRECTOR IN CENTER)

SENIOR DIR: (TURNS TO DIRECTOR)

Is it a Tallyho?

DIRECTOR 1: TALLYHO ON 28!

(SOME SECONDS OF WILD ACTIVITY FOLLOWING ANNOUNCEMENT OF TALLYHO)

CUT TO: (CONTROL ROOM AND RECORDERs)

SENIOR SIR: What's he see, Lee?

DIRECTOR 1: Roger, Blackjack Red, your next check point is 334. Over.

CUT TO: (CPB SHOT)

CONTROL TECH: Kingpin, we've just got a Tallyho on ...

DIRECTOR 1: Roger. Bogie now 12 o'clock, 20 miles ... Hello, Redbird White, your Bogie is now 11 o'clock, 15 miles. Over.

DIR 1 TECH: Did you get the angels on the Bogie, sir?

DIRECTOR 1: 28.

DIR 1 TECH: 28 Angels, all right.

DIRECTOR 1: Roger, Blue, maintain surveillance.

SENIOR DIR: Senior Director, here, still UNKNOWN? Roger.


CUT TO: (FULL STATION SHOT WITH SENIOR DIRECTOR IN CENTER. SENIOR DIRECTOR IS ON PHONE.)
DIRECTOR 1: TALLYHO ON 29.

SENIOR DIR: ... Scramble Blackjack White and Blue ... yes, vector point 275 ...

DIRECTOR 1: (TO MI OFFICER BECAUSE SENIOR DIRECTOR IS OCCUPIED ON PHONE)
28 is two B-29-type aircraft.

SENIOR DIR: ... Angels 30 on Channel 1. We're going after 28 and 29 -- there's two aircraft in each track.
Roger, out.

DIRECTOR 1: (LEANS OVER TO TALK TO SENIOR DIRECTOR)
Major, 28 is two B-29-type with no marking.

CONTROL TECH: (ON PHONE DURING CONVERSATION BETWEEN DIRECTOR 1 AND SENIOR DIRECTOR)
Kingpin, we just scrambled Blackjack White and Blue.

SENIOR DIR: (TURNS TO MI OFFICER)
Nothing on it?

CUT TO: (CLOSEUP OF MI OFFICER)

DIRECTOR 1: No markings. (ALTHOUGH TECH ON PHONE SWAMPS THE LINE)

CUT BACK TO: (FULL SHOT OF ADDC)

SENIOR DIR: Nothing? POUNCE!

(TECHNICIAN STILL TALKING ON PHONE)
Going on Red at 53.

CUT TO: (CPB SHOT)

DIRECTOR 1: Redbird Blue ... this is Cogwheel. Pounce. Over.
NARRATOR: The Senior Director makes the decision to open fire.

SENIOR DIR: This is Cogwheel. We've got hostiles in the area. We're going on Red at 53. Move everything up to ready ... all fighters ready ... all right ... Hello, Kingpin, lemme talk to the Senior Controller ... This is Cogwheel. On this track Charlie 28 -- -- it's HOSTILE.

NARRATOR: The Senior Director immediately informs all organizations concerned that he has declared an emergency - -- a red alert.

SENIOR DIR: We've gone on Red at 53 ...

DIRECTOR 1: ... Investigate Bogie.

SENIOR DIR: ... Roger, out.

(SENIOR DIRECTOR AND TECHNICIAN PUT DOWN PHONES.
DIRECTOR 1 STILL ON PHONE)

CUT BACK TO: (FULL STATION SHOT)

DIRECTOR 1: TALLYHO ON 30!

(TURNS TO MI OFFICER)

Two Bogies in 30.

SENIOR DIR: (PICKS UP PHONE)

Senior Director ... Red on 53. (PUTS DOWN PHONE)

DIRECTOR 1: (ON PHONE)

Roger, White. Maintain surveillance. White, do you see any markings of any kind?

CUT TO: (CPB SHOT)
DIRECTOR 1: Roger, White ... understand.

(TURNS TO SENIOR DIRECTOR)
White has a B-29-type Bogie that's track Charlie 29, no marking.

SENIOR DIR: No marking? One aircraft?

DIRECTOR 1: One aircraft.

MI OFFICER: Charlie 29?

DIRECTOR 1: Charlie 29.

SENIOR DIR: Nothing on 29? (TO MI OFFICER)

CUT TO: (CPB SHOT)

NARRATOR: Good decisions are not necessarily all fast. Because Charlie 29 is farther away, the Senior Director tries to get more information before opening fire.

DIRECTOR 1: (TO MI OFFICER)
30 has two ... Go ahead, Red! Roger.

CUT BACK TO: (FULL STATION SHOT)

SENIOR DIR: (TURNS TO MI OFFICER)
What did you get on 29?

MI OFFICER: We have nothing, sir.

SENIOR DIR: POUNCE 29.

DIRECTOR 1: (IN BACKGROUND)
Roger, Red. Maintain surveillance.

CONTROL TECH: Kingpin, we ordered a splash on 29.

DIRECTOR 1: Redbird White, POUNCE. Over.

CUT TO: (REAR VIEW OF TOP DECK WITH FOUR EXPERIMENTERS IN FOREGROUND)
DIRECTOR 1: Pounce!
(CAMERA PANS TO OTHER EXPERIMENTAL PERSONNEL)

DIRECTOR 1: (VOICE IN BACKGROUND)
Track 30 is two B-29-type aircraft with no
markings. (PAUSE) Hello, Redbird Blue.
(PAUSE) Over.

CUT BACK TO: (FULL STATION SHOT)
SENIOR DIR: (TURNS TO MI OFFICER)
Nothing?

MI OFFICER: Negative, sir.

SENIOR DIR: Pounce Charlie 30, too.

DIRECTOR 1: Redbird, Blue. Maintain surveillance on the
other aircraft. Over.

TECHNICIAN: Kingpin ordered a splash on 30 at 56.

SENIOR DIR: Lemme talk to the Senior Director. This is
Cogwheel, here. We've got three tracks, Charlie
28, 29, and 30. They're all hostile ... We've
ordered them pounced ... There's approximately
five hostiles in the area, and we still have one
Unknown.

DIRECTOR 1: (BREAKS INTO PREVIOUS SPEECH)
Splash one on 28!

SENIOR DIR: (STILL ON PHONE)
I wish you'd alert Handshake to stand by to back
us up ... We just got one splash on 28 ... Roger,
out.
CUT TO: (CPB SHOT)

NARRATOR: This isn't the end of the Cogwheel story. As you have seen, ...

CUT TO: (SECRETARY AT FILE DRAWERS)

NARRATOR: ... a great amount of data was collected about the Cogwheel crew. And Cogwheel was only one of ...

CUT TO: (PAN SHOT OF FILE CABINETS WITH LABELS: CASEY, COWBOY, COBRA, AND COGWHEEL. THEN SECRETARY OPENS DRAWER TO SEARCH.)

NARRATOR: ... four experiments with four different crews. The information obtained during these experiments, as well as the ...

CUT TO: (CLOSEUP OF BIEL AND TYO)

NARRATOR: ... research methods that were developed, have many applications for the ...

CUT TO: (MONTAGE OF UNCLASSIFIED SYSTEM TRAINING PROGRAM MATERIAL: BOOKLET, BIEL AND TYO, CLOSEUP OF INSIDE OF BOOK, CLOSEUP OF BIEL)

NARRATOR: ... improvement of system performance through training, design, and management. But good applications depend on understanding how organizations work.

CUT TO: (SHOT OF CLERKS WORKING ON DATA)

NARRATOR: So the experimental staff has done a great deal of analysis. From the 12,000 hours of recordings that were collected, ...
CUT TO: (CHANGING RECORD ON AUDOGRAPH)
NARRATOR: ... much information has been successfully coded onto nearly ...
CUT TO: (KEYPUNCH)
NARRATOR: ... half a million punched cards.
CUT TO: (SORTER OPERATION)
NARRATOR: Many analytical and statistical processes have been used ...
CUT TO: (CLERKS PLOTTING OFF AN IBM SUMMARY BOOK)
NARRATOR: ... in the search for valid concepts to describe a complex system's operation.
MUSIC UP:
NARRATOR: Each step ...
CUT TO: (CLOSEUP OF GRAPH BEING PLOTTED)
NARRATOR: ... in reducing the data brings the scientists closer to a theory of organizations.
CUT TO: (CLOSEUP OF THREE REPORTS)
CUT TO: (CHAPMAN AND KENNEDY)
NARRATOR: The results of these RAND studies and the methods used to obtain the results have given us a key to a new and better understanding of the many factors involved in organizational effectiveness.
CUT TO: (SUPERIMPOSE CREDITS ON PICTURE OF RAND BUILDING)
FADE OUT.
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Also see RM-1427 in first subheading of bibliography.

Experimental Methodology


